ICAMR 2018

The 8th International Conference on Advanced Materials Research

With workshops of

The 2nd International Conference on Civil and Building Materials &

International Conference on Advanced Energy Materials

Jan. 20-22, 2018

Fukuoka, Japan

Organized by

Technical Sponsored by

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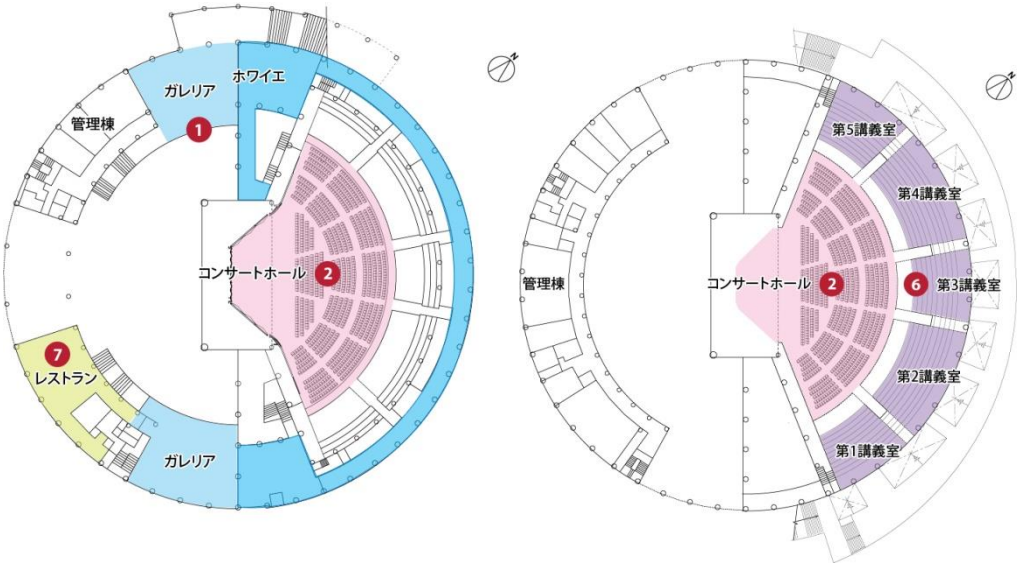
Conference Venue

Shiiki Hall

Ito Campus of Kyushu University

Address: 744 Motohioka Nishi-ku, Fukuoka-shi 819-0395, Japan
(〒819-0395 福岡市西区元岡 744 番地(九州大学 伊都キャンパス内)).
Tel: +092-802-2160, 2161 Mail: shiikihall@jimu.kyushlu.ac.jp
http://shiiki-hall.kyushu-u.ac.jp/

Floor Plan



2F **3F/4F**

Transportation to Ito Campus:

Air

Fukuoka Airport →(Subway Kuko Line)→Meinohama Station (Transfer JR Chikuhi Line) →
Kyudai-Gakkentoshi Station→Showa Bus→Ito Campus

福岡空港 →(地下鉄空港線)→「姪浜駅」(JR 筑肥線へ乗換)→「九大学研都市駅」→昭和バス→「伊都キャンパス」

※Alternatively, board a train bound for NishiKaratsu or Chikuzen-Maebaru, which eliminates the need to transfer at Meinohama Station.

※西唐津行き、筑前前原行きに乗車した場合は、姪浜駅での乗り換えは不要。

Fukuoka Airport →(Subway Kuko Line)→Hakata Station→Nishitetsu Bus→Ito Campus

福岡空港 →(地下鉄空港線)→「博多駅」→西鉄バス→「伊都キャンパス」

JR Train

JR Hakata Station→(Subway Kuko Line)→Meinohama Station (*Please see “Air” above.)

「JR 博多駅」→(地下鉄空港線)→「姪浜駅」(あとは空路の場合と同じ)

JR Hakata Station→Nishitetsu Bus→Ito Campus

「JR 博多駅」→西鉄バス→「伊都キャンパス」

Nishitetsu Train

Nishitetsu-Fukuoka Station →(Subway Kuko Line) →Meinohama Station(*Please see “Airplane” above.)

「西鉄福岡駅」→(地下鉄空港線)→「姪浜駅」(あとは空路の場合と同じ)

Nishitetsu-Fukuoka Station →Nishitetsu Bus →Ito Campus

「JR 博多駅」→西鉄バス→「伊都キャンパス」

Highway Bus

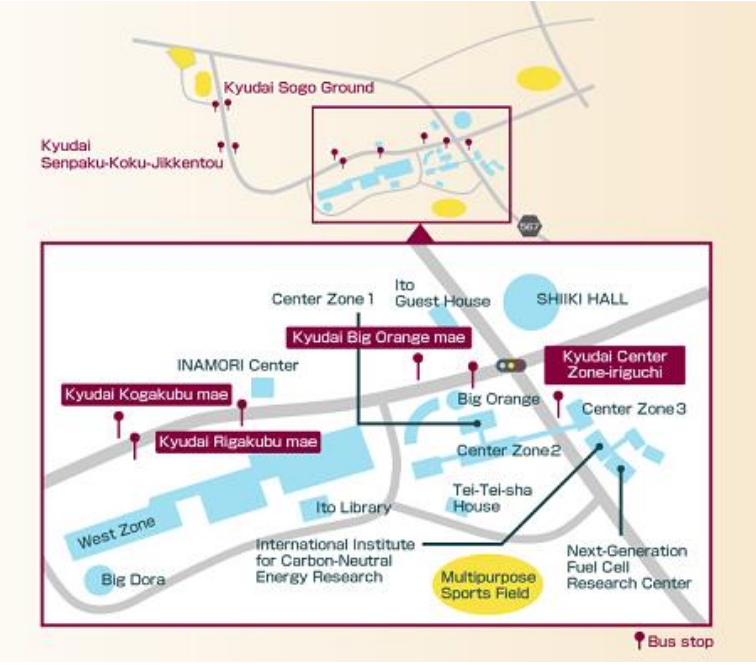
Nishitetsu Tenjin Bus Center →(Subway Kuko Line)→Meinohama Station(*Please see “Airplane” above.)

天神バスセンター→(地下鉄空港線)→「姪浜駅」(あとは空路の場合と同じ)

Nishitetsu Tenjin Bus Center →Nishitetsu Bus →Ito Campus

天神バスセンター→西鉄バス→「伊都キャンパス」

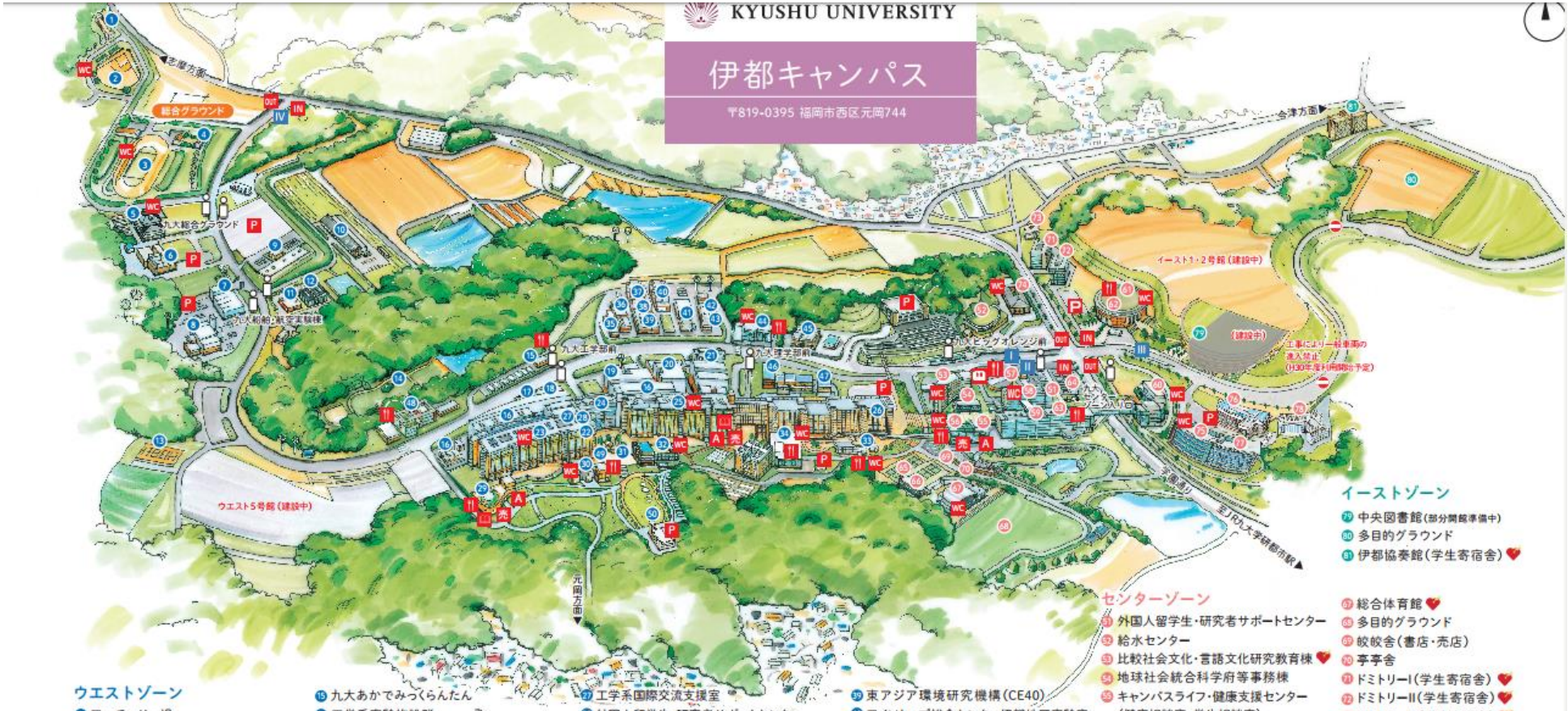
Access Map:



KYUSHU UNIVERSITY

伊都キャンパス

〒819-0395 福岡市西区元岡744



ウエストゾーン

1. アーチェリー場
2. 野球場
3. 陸上競技場
4. 弓道場
5. 課外活動施設II
6. 加速器・ビーム応用科学センター(CE70)
7. 船舶海洋性能工学実験棟(EN80)
15. 九大あかでみっくらんたん
16. 工学系実験施設群
17. 工学系総合研究棟(コラボ・スペース)
18. 鉄鋼リサーチセンター(EN40)
19. 水素ステーション
20. 水素エネルギー国際研究センター(HY30)
21. 水素材料先端科学研究センター(HY10)
22. キャンパスライフ・健康支援センター
27. 工学系国際交流支援室
28. 外国人留学生・研究者サポートセンター グローバル学生交流センター
29. ビッグどら(食堂・喫茶・売店・書店)
30. 西講義棟、E-café(喫茶)
31. 石のアート QIAO(チャオ)
32. 総合学習プラザ
33. ビッグリーフ(食堂・喫茶)
39. 東アジア環境研究機構(CE40)
40. アイソトープ総合センター伊都地区実験室
41. 超高圧電子顕微鏡棟 (超顕微解析研究センター)(CE20.21)
42. パブリック1号館(CF1)
43. 国際宇宙天気科学・教育センター(CE10)
44. 稲盛財団記念館 (稲盛フロンティア研究センター)

センターゾーン

51. 外国人留学生・研究者サポートセンター
52. 給水センター
53. 比較社会文化・言語文化研究教育棟
54. 地球社会統合科学府等事務棟
55. キャンパスライフ・健康支援センター (健康相談室、学生相談室)
56. ビッグさんど(食堂・売店)
57. ビッグオレンジ(情報発信拠点)
58. センター1号館
59. センター2号館
60. センター3号館
61. 椎木講堂

イーストゾーン

79. 中央図書館(部分開館準備中)
80. 多目的グラウンド
81. 伊都協奏館(学生寄宿舎)
57. 総合体育館
58. 多目的グラウンド
59. 皎皎舎(書店・売店)
70. 亭亭舎
71. ドミトリーI(学生寄宿舎)
72. ドミトリーII(学生寄宿舎)
73. ドミトリーIII(学生寄宿舎)
74. 伊都ゲストハウス
75. カーボンニュートラル・エネルギー国際研究所(I²CNER)第1研究棟
76. カーボンニュートラル・エネルギー国際研究所(I²CNER)第2研究棟
77. 次世代燃料電池産学連携研究センター

Welcome Address

We would like to welcome you to ICAMR 2018, the 8th International Conference on Advanced Materials Research, being held from Jan. 20 to Jan. 22, 2018, in Fukuoka, Japan. The conference will be held with 2 workshops: 2018 The 2nd International Conference on Civil and Building Materials, and 2018 International Conference on Advanced Energy Materials. The conference is held in Shiiki Hall, Ito campus of Kyushu University, located in Fukuoka, Japan.

After several rounds of review procedure, the program committee accepted those abstracts to be presented on conference, and papers to be published in conference proceedings. We wish to express our sincere appreciation to all the individulas who have contributed to ICAMR 2018 conference in various ways. Special thanks are extended to our colleagues in the program committee for their thorough review of all the submissions, which is vital to the success of the conference, and also to the members in the organizing committee and the volunteers who had delicated their time and efforts in planning, promoting, organizing and helping the conference.

This conference program is highlighted by Four Keynote Speakers: Prof. Alan Lau, Swinburne University of Technology, Australia; Prof. Mattheus F. A. Goosen, Alfaisal University, Saudi Arabia; Prof. Serge Zhuiykov, Ghent University Global Campus, South Korea; Prof. Ando Tatsuo, The University of Tokyo, Japan, and Four Plenary Speakers: Prof.Alfred A.Christy, University of Agder, Norway; Prof. Sung-Hoon Kim, Silla University, Republic of Korea; Prof. Yufeng Zheng, Kumamoto University, Japan; Prof. Takahiro OHASHI, Kokushikan University, Japan..

One best presentation will be selected from each session, evaluated from: originality; applicability; technical Merit; qualities of PPT; English. The best one will be announced and awarded the certificate over the banquet after the conference.

The city of Fukuoka, also known as Hakata, is not only the center of administration and economy in the Kyushu region but also a terminal for air routes and railroads. The Hakata Dontaku is a colorful port festival held in summer each year. Highlighted by a parade of children in traditional dress, men and women in fancy costume, and 'te-odori' dancing (dancing with nothing in hand) people through the streets, this event draws more than 580 groups and about 31,000 citizens, and is viewed by more than 2 million spectators.

We wish you a successful conference and enjoyable experience in Fukuoka!

Conference Organizing Committee
Fukuoka, Japan

Organizing Committee

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Prof. Mattheus F. A. Goosen,Alfaisal University,Saudi Arabia

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Prof. Jung-Kul Lee, Konkuk University, South Korea
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Dr. Badin Damrongsak, Silpakorn University, Thailand
Dr. Sirirat Wacharawichanant, Silpakorn University, Thailand
Dr. Rajashekar Patil, Smvitm Bantakal, India
Dr. Patcharaporn Thitiwongsawet, Thammasat University, Thailand
Dr. Trong-Phuoc Huynh, Can Tho University, Vietnam

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Dr.Weerapol Namboonruang, Muban Chombueng Rajabhat University, Thailand
Dr. Hasnah Mohd Zaid, Universiti Teknologi Petronas, Malaysia
Prof. Achanai Buasri, Silpakorn University, Thailand

Useful Info

Time

UTC/GMT+9

Weather

The Weather Situation of Fukuoka in Jan.

Average daily minimum temperature	Average daily highest temperature
2℃	9℃

Money

Japanese Yen (¥).
There is no limit on the amount of any currency that may be brought into or taken out of Japan. However, if you transport (any currencies, checks, securities or other monies) exceeding 1,000,000 yen worth in Japanese currency into or out of the country then you must complete a customs declaration.
You can buy yen at foreign exchange banks and other authorized money exchangers. At the international airports, currency exchange counters are usually open during normal office hours. The exchange rate fluctuates daily depending on the money market.
On the rare occasion that you actually need to give a tip in Japan, do so by putting the money inside of a tasteful, decorative envelope and seat it. Hand it to the recipient with a slight bow; do not expect them to open your "gift" right away.
Pulling cash out of your pocket in full view of the recipient is the worst way to give a tip in Japan.

Transportation

Fukuoka is served by Japan Railways (JR), Nishitetsu Railways, three subway lines and a bus network. The city's main station is Hakata Station with direct connections to Honshu and across Kyushu, including Nagasaki, Kumamoto and Kagoshima.
The local railway company Nishitetsu is useful for visiting Dazaifu. Nishitetsu trains depart from Tenjin Station (also known as Nishitetsu Fukuoka Station) in the central entertainment and shopping district of Tenjin. Most city buses in Fukuoka are also operated by Nishitetsu.
The subway connects Hakata Station, Tenjin Station and Fukuoka Airport with each other and provides access to many of the city's tourist attractions. Fukuoka Airport is Japan's most centrally located airports, only a five minute subway ride from Hakata Station.
The 100 Yen Bus is a convenient, frequently running bus line that loops through the city center between Hakata and Tenjin Stations, passing by Canal City and the food stalls of Nakasu Island.

Buses run at least once every 10 minutes, and the fare is 100 yen per ride.

Electricity is 100 Volts, which is different from North America (120V), Central Europe (220V) and most other regions of the world. Japanese electrical plugs have two, nonpolarized pins.

Emergency Contact

If you are involved in a traffic accident or crime

・Emergency Contact TEL：110

If you need emergency treatment for an illness or injury

・Emergency Contact TEL：119

*Part of the local information above comes from the network.

Instructions for Presentations

Oral presentations

Oral presentations have been allocated 15 minutes of effective presentation time, including Q/A time.

Authors must prepare their oral presentations to be sure to convey their message in clear and sharp manner, including giving outline of the key principles, facts and results. More detailed discussions can continue during the breaks.

In order to ensure a smooth performance during your session, we kindly ask you to consider the following instructions:

Be at the session room 15 minutes before session starts and introduce yourself to the session chairs.

A video projector and a PC will be available in all conference rooms. Speakers suggested not use their own laptop computer, avoiding useless time breaks in between papers.

Bring your presentation on a USB memory stick in MS-PowerPoint or Adobe PDF formats, and upload it in the Session Room computer no later than 10 minutes prior to your session start! You can also bring it earlier, during the coffee/lunch breaks before your presentation. Please upload your presentation in a right place in order to find it easily at the time of presentation.

Please wear formal clothes or national characteristics of clothing for participation.

In order to avoid any compatibility problems, read carefully the instructions below.

PowerPoint Instructions

For MS-PowerPoint presentations, please use the following versions only: PP 97-2003 (*.ppt) or 2007, 2010 to guarantee that it will be opened successfully on the on-site PC

We recommend to the PPT/PPTX format instead of PPS

All videos or animations in the presentation must run automatically!

Pictures/Videos

We cannot provide support for embedded videos in your presentation; please test your presentation with the on-site PC several hours before your presentation.

In case your video is not inserted in MS-PowerPoint, it is possible to have it in other formats – MPEG 2,4, AVI (codecs: DivX, XviD, h264) or WMV. Suggested bitrate for all mpeg4 based codecs is about 1 Mbps with SD PAL resolution (1024x576pix with square pixels, AR: 16/9).

Fonts

Only fonts that are included in the basic installation of MS-Windows will be available (English version of Windows). Use of other fonts not included in Windows can cause wrong layout/style of your presentation.

Suggested fonts: Arial, Times New Roman.

If you insist on using different fonts, these must be embedded into your presentation by choosing the right option when saving your presentation:

Click on "File", then "Save As"

Check the "Tools" menu and select "Embed True Type Fonts"

Poster presentations

Suggested Poster with size of 60cm*80cm (width*height).

Posters are required to be condensed and attractive. The characters should be large enough so that they are visible from 1 meter apart.

During poster session, the author should stand by your poster, explaining and answering doubts or questions.

Keynote Speech

Keynote Speech I:

Prof. Ando Tatsuo (The University of Tokyo, Japan)

Fire Safety of Polymer-Based Building Materials and Test Methods in Japan

Building materials, especially polymer-based ones, currently used in Japan have been reviewed and re-evaluated form the viewpoint of in-use fire safety in buildings. Recently polymer-based building materials have been widely used in Japan. While the use of these materials greatly contribute to energy savings, indoor comfort, cosmetics, weight reduction and many other functions of buildings, some of them adversely contribute to the spread of flame in the event of fire, even if they are approved as self-extinguishing, flame-retardant or non-combustible. Current small-scale flammability test on building materials in Japan is not always good enough to predict the flame spread and fire safety of buildings.

In-use, larger-scale evaluation of building materials often revealed quite different and unexpected dangerous results. Based on intermediate- or large-scale fire tests, new JIS (Japanese Industrial Standard) methods have been developed. These are the fruit of the collaboration with fire- and polymer engineers on the building materials research for the additional enhancement of fire safety of buildings.

Findings, measures, international cooperation and the ways to these standards are introduced and discussed:

1) Test method for fire propagation over building facades (JIS A 1310-2015), and

2) Reaction to fire test for sandwich panel building interior systems – Box test (JIS A 1320-2017).

Bio: Professor Ando Tatsuo was born in Tokyo, Japan in 1949. He conducted architectural studies at the University of Tokyo, mainly in durability and fire safety of building materials. Right after receiving the Master's degree from the University of Tokyo in 1976, he joined Mitsubishi Chemical Industries, Ltd. (now Mitsubishi Chemical Corporation) and did research and development of advanced composite building materials for 39 years. During his tenure at Mitsubishi, he worked for 5 years at Mitsubishi Chemical America, in Virginia, USA as technical service manager of composites. He was also responsible for the corporate research and development for 3 years as head at the Research Center, Mitsubishi Chemical Functional Products, Inc. His major responsibility included aluminum laminated composite materials (ACM), carbon fiber composites and refractory alumina fiber mostly for building sector. He has been an active member of Architectural Institute of Japan (AIJ), and Japan Association of Fire Science and Engineering (JAFSE). He was also one of the national delegates to ISO/TC92/SC1 (Fire Initiation and Growth) for 15 years. His current interest covers the fire safety of building materials, mainly combustible composite materials used for façade and interior finish. He has been engaged in

campaigning worldwide to make people aware of the fire safety of facades.

In April 2015 he came back to the University of Tokyo as an academic support at the Department of Architecture and is currently engaged in research and development of fire tests including JIS A1310:2015 “Test method for fire propagation over building facades.” and JIS A1320:2017 “Reaction to fire test for sandwich panel building interior systems --- Box test.”

Keynote Speech II:

Prof. Alan Kin-tak Lau (Swinburne University of Technology, Australia)

Structural Performance and Health Monitoring of Polymer-based Composites at Harsh Environment

Polymer-based advanced composites always suffer from degradation at extreme temperatures in the range between 220 and 77 K and low atmospheric pressure. Within this temperature range, composite structures behave very brittle and many micro-cracks are easily formed due to differential thermal coefficients of expansion (CTEs) between polymer matrix and high strength reinforcements. Besides, at the Low Earth Orbit (LEO) environment the structures may also be subject to damages due to micro-meteoroid attack, in which many tiny particles left over from the formation of the solar system and they are travelling at very high speed (hyper-velocity) to cause serious impact and abrasion onto the structures. Out-gassing and high oxidation rate are also problems for polymers using at this environment. For atmospheric re-entry vehicles, due to their high speed return, the surface of the vehicles facing to the entry direction has to maintain its strength at very high temperature (~ 3500 K) when they are passing through the atmospheric layer within a short period of time. Different research works have been conducted to design ablators (thermal protection system, TPS) to minimize the weight and thickness of ablating, charring and pryrolyzing zones worldwide. Materials used for the ablators must efficiently cool the vehicles via energy absorption of the endothermic breakdown of the polymeric constituents, transpiration cooling as the pyrolysis gases percolate from the interior of the material toward the surface, and re-radiation from the hot char layer that forms on the surface. The geometry of the re-entry shape can minimize the heat induced by controlling the form (blunt body theory) of shock wave. Therefore, studies on using nano-particles to enhance the anti-cracking resistant properties and prolong the pryrolzing process are necessary. Besides, due to the increasing use of polymer-based nanocomposites at extreme environment condition, their inspectability becomes a hot topic, at least in coming 5 years to explore more real-time or remote health monitoring techniques to ensure the safety of structures. Embedded sensors, self-healing technology and smart structure designs are most prominent research fields for nanocomposite structures.

In this lecture, an overview on the nanocomposites, their mechanical, thermal and structural properties at different working environments is given. The following key items will also be introduced: (i) design of the heat shield's geometry for re-entry vehicles; (ii) shock wave effect in relation to the heat transmission to the vehicles; (iii) advantage of using Phenolic Resin Carbon Ablator (PICA); (iv) types of nanoparticles for property enhancement for the vehicles and (v) possibility of using nano-particles (nanotubes, nanoclay, nano-silica, silica-aerogel, etc) to enhance the effectiveness of pyrolyzing process of PICA to prolong the heat transfer. The potentiality of using different structural monitoring techniques to serve at the extreme environment will also be discussed.

Bio: In 1987, Dr. Lau joined the Hong Kong Aircraft Engineering Company Ltd (HAECO) where he was employed as a craft apprentice in the aircraft maintenance division for 4 years. He received his Bachelor and Master degrees of Engineering in Aerospace Engineering from the Royal Melbourne Institute of Technology (RMIT University, Australia) in 1996 and 1997, respectively. Within that period, he also worked for General Aviation Maintenance Pty Ltd, Australia, as an Engineer Trainee, and for the Corporative Research Centre for Advanced Composite Structures (CRC-ACS) Australia, as a Research Assistant designing a repair scheme for composite performs. He received his Doctor of Philosophy (PhD) from The Hong Kong Polytechnic University in 2001. Thereafter, he was appointed Assistant Professor in 2002 and promoted to Associate Professor and Full Professor in 2005 and 2010, respectively. In 2013, he was appointed as Associate Dean (Industrial Relations) of the Faculty of Engineering and Alex Wong/Gigi Wong Endowed Professor in Product Design Engineering.

Based on his outstanding research performance in the fields of advanced composites, FRP for infrastructure applications, smart structures and nano-materials, he has received numerous awards (for both research and teaching) including: The Best Paper Awards on Materials (1998), The Sir Edward Youde Memorial Fellowship Award (2000), Young Scientist Award (2002), Young Engineer of the Year Award (2004), Faculty Outstanding Award for Research and Scholarly Activities (2005), Award for Outstanding Research in Nanocomposites for Space Applications, USA (2006), Chemical Physics Letters, Most Cited Paper 2003- 2007 Award, President Award in Teaching 2008, Award for Innovative Excellence in Teaching, Learning and Technology at the 20th International Conference on College Teaching and Learning, USA (2009). He is also the Winner of the Ernest L. Boyer International Award for Excellence in Teaching, Learning, and Technology, in the same Conference (the first scholar outside the United States to receive this honour) and the Most Cited Paper Awards in Composites Part B: Engineering (issued by Elsevier Science). In 2011, Dr. Lau received the Outstanding International Researcher Award and the Outstanding International Research Leader Award from the International Association of Multidisciplinary Research (IAMR). This marks the first time that anyone has received both the awards making his achievement quite exceptional. In 2013, he was also awarded The University Grant Committee (UGC) Award for Teaching Excellence.

Due to his significant contribution to the field of science and engineering, he was elected as a Fellow of the European Academy of Sciences in 2007, with the citation “For profound contributions to materials science and fundamental developments in the field of composite materials”, and was the first scholar in Hong Kong to receive this honor. In 2016, he was also elected as a Fellow of European Academy of Sciences and Arts. Three of his articles published in Composites Part B: Engineering; Composites Science and Technology; and Chemical Physics Letters were ranked in the TOP 1% MOST CITED ARTICLES within their field in 2006 and 2007, according to Essential Science IndicatorsSM. Six of his papers have been ranked among the top 25 hottest articles in Composites Part B: Engineering, issued by ScienceDirect, Elsevier (two of them were ranked No. 1 in 2007). Since 2002, Dr Lau has edited 5 books and published over 260 scientific and engineering articles and his publications have been cited over 4900 times with an h-index of 34 (Google citation 12,000 with the h-index of 52). Dr. Lau has also actively participated in many consultancy works with the industry. The scope of his works have mainly focused on failure analyses on different engineering systems.

Keynote Speech III:

Prof. Mattheus F. A. Goosen (Alfaisal University, Saudi Arabia)

Applications of Advanced Materials in Renewable Energy Technologies

The utilization of advanced materials in renewable energy technologies is indispensable to meet the rising demand for applications such as water desalination. Nevertheless, the growth of renewable energy sources to run commercial processes at a larger scale is hindered by technical, economic, regulatory and environmental challenges including new material development. This critical review focusses on integrated approaches in using renewable energy such as solar and geothermal technologies for water desalination. Advanced materials research plays a crucial role in these areas. Innovative and sustainable processes which are suitable for renewable energy systems are also presented, along with the benefits of these technologies and their limitations. The market potential, environmental concerns, regulatory & socio-economic factors are likewise evaluated as well as the need for accelerated development of renewable energy-driven technologies.

Bio: Professor Mattheus (Theo) F. A. Goosen has played key roles in the development of new start up academic institutions. For the past nine years he has held the position of founding Associate Vice President for Research & Graduate Studies at Alfaisal University a private start-up non-profit institution in Riyadh, Saudi Arabia (www.alfaisal.edu). The doctoral degree of Dr Goosen is in chemical & biomedical engineering from the University of Toronto (1981) Canada. Theo has more than 180 publications to his credit including over 137 refereed journal papers, 45 conference papers, 11 edited books and 10 patents. His h index is over 48 and he has well over 9000 citations on Google Scholar. On Scopus he has over 137 publications with over 4500 citations. Dr Goosen's research interests are in the areas of renewable energy, desalination, sustainable development, membrane separations, spray coating technology and biomaterials.

Keynote Speech IV:

Prof. Serge Zhuiykov (Ghent University Global Campus, South Korea)

Surface Functionalization of Two-dimensional Vertically Aligned Semiconductor Heterojunctions

Large-scale fabrication of two-dimensional (2D) nanomaterials by vapor phase depostion enabled the establishment of vertically aligned semiconductor herterojunctions. However, the property modulation of 2D semiconductor heterojunctions remains chanlleging within such thin layers. Herein, we proposed a general strategy towards the surface functionlization of 2D semiconductor heterojunctions simply by two-step atomic layer deposition (ALD) process with following post-annealing. TiO_2-WO_3 heterojunction was taken as a typical case in this work and its electrochemical properties were significantly improved via the proposed strategy. This strategy may open a new pathway for facile functionalization of 2D nanomaterials for the energy conversion and storage devices.

Bio: 2015 – present, Professor, Ghent University Global Campus

2004 – 2015, CSIRO Materials Science and Engineering Division, Melbourne

2004 – 2006, Senior Lecturer (part time). Industrial Science Department, Swinburne University of Technology, Melbourne, VIC. 3122, Australia

2002 – 2004, Manager, SSL, Australian Government Analytical Laboratories,177 Salmon Str., Port Melbourne, VIC. 3207, Australia

PROFESSIONAL AFFILIATIONS

2009 – present, Member of the American Nano Society (ANS);Member of the American Nano Society (ANS); 2006 – present, Member of the Electrochemical Society (ECS); 2002 – present, Member of the Fire Protection Association of Australia (FPAA); 1995 – present, Member of the Australasian Ceramic Society (ACS); 1994 – present, Member of the American Ceramic Society (ACerS);

Plenary Speech

Plenary Speech I:

Prof. Yufeng Zheng (Kumamoto University, Japan)

New Directions and Technologies for Metallic Biomaterials

Traditional metallic biomaterials, including stainless steels, Co-based alloys, and titanium and its alloys, are mainly used for replacing failed hard tissue, for example, artificial hip joints, artificial knee joints, boneplates, dental implants, etc. The key issues for the material design involved the excellent mechanical property, corrosion resistance, and biocompatibility, and under the body fluid condition they acted as bio-inert implant, and sometimes exhibited surface bio-active after a certain surface pre-treatment. Since 2000 new groups of revolutionizing metallic biomaterials had been developed such as anti-bacterial functionalized stainless steel, biodegradable metals (Mg-based, Fe-based and Zn-based) with the bioactivity, and novel structured metallic biomaterials had been fabricated to improve the performance of metallic biomaterials, such as amphorous bulk metallic glasses with lower elastic modulus but high elastic limit, nanocrystalline pure metals and alloys by severe plastic deformation with improved ion release behavior or enhanced bone formability, preciously-controlled porous structures with 3-dimensional printing technique for custom-personalized bone scaffold design, composited with bioceramics and biopolymers with improved mechanical properties and biocompatibility. All these new-emerging metallic biomaterials are regarded as revolutionized metallic biomaterials and bring new chances for extending their future applications in clinic. Moreover, with the development of these promising metallic biomaterials, the original principle for the alloying element selection during the alloy design changes from the passive inhibition of the released toxic metal ions (Ni in biomedical TiNi alloy) during the implantation period, to the active introduction of the certain metal elements with specific biofunctions into the material (for example, adding osteo-induced elements Zn, Ca and Sr into the Mg to enhance the bone formability), and bring new vitality for the biomedical applications such as dentistry, orthopedics, cardiology, interventional therapy, gynecology, hepatobiliary surgery, etc.. Diverse surface treatment technologies had been explored on these new metallic biomaterials with further improvement of their performance within human body. All these advances make the metallic biomaterials better fit for the requirement of next-generation engineered tissue reconstruction scaffold. The emphasis of this presentation is to illustrate these newly-emerging metallic biomaterials in 21th century, with more bioactivity and biofunctions such as biodegradation, anti-bacterial function, osteoinductive function, radiopacity and MRI compatibility.

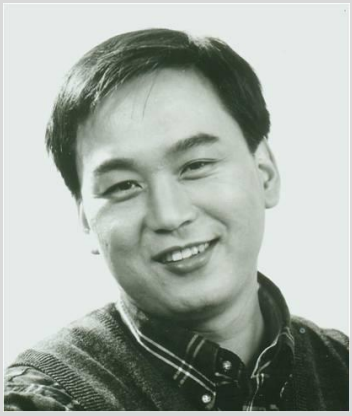
Bio: Prof. Yufeng Zheng, received his Ph.D in materials science from Harbin Institute of Technology, China in 1998. From 1998 to 2004 he was Assistant Professor (1998-2000), Associate Professor (2000-2003), Full Professor (2003-2004) at Harbin Institute of Technology, China and since 2004 he has been a full professor at the Peking University in Beijing, China. He is currently working as distinguished professor at International Research Organization for Advanced Science and Technology, Kumamoto University, Japan. Dr. Zheng has authored or co-authored over 380 scientific peer-reviewed articles, with the citation of over 9500 times (http://www.researcherid.com/rid/A-4146-2010), and a H-index of 48. He served as the Editor-in-Chief of Bioactive Materials, Editor of "Materials Letters" (http://www.sciencedirect.com/science/journal/0167577X), Associate Editor-in-Chief of "Journal of Materials Science & Technology" (http://www.sciencedirect.com/science/journal/10050302). His areas of special interest include the development of various new biomedical metallic materials (biodegradable Mg, Fe and Zn based alloys, beta-Ti alloys with low elastic modulus, bulk metallic glass, ultra-fine grained metallic materials, etc). Dr. Zheng has received several awards including New Century Excellent Talents in University awarded by MOE of China (2007), Distinguished Young Scholars awarded by NSFC (2012) and Cheung Kong Scholars Programme awarded by MOE of China (2016).

Plenary Speech II:

Prof. Sung-Hoon Kim (Silla University, Republic of Korea)

Controllable Synthesis of Carbon Coil Hybrid Materials and their Shielding Effectiveness for the Electromagnetic Wave Radiation

The formation of the carbon nanocoils-carbon microcoils (CNC-CMC) hybrid materials, namely the formation of the numerous carbon nanocoils (CNCs) on the surface of the carbon microcoils (CMCs), could be achieved using C2H2 as the source gas and SF6 or CS2 as the additive gas in a thermal chemical vapor deposition system. During the reaction, SF6 or CS2 was injected into the reactor in modulated on/off cycles. The CNC–CMC hybrid materials were not observed without the on/off cycles of SF6 or CS2 flow. When we varied the number of the on/off cycles, the density of CNCs formed on the surface of CMCs increased with increasing the on/off cycle number. The cause for the difference in CNC–CMC formation with cycle number was investigated. Based on the results, a growth mode of the CNC–CMC hybrid materials was proposed.
Composites of CNC-CMC hybrid materials in polyurethane (CNC-CMC@PU) and CMCs in polyurethane (CMC@PU) were fabricated. The CNC-CMC@PU composites showed the higher shielding effectiveness than those of CMC@PU composites, irrespective of the mixture ratios of carbon nanomaterials in PU. Based on the resulting shielding effectiveness and the electrical conductivity values we conclude that the formation of the CNC-CMC hybrid materials can enhance the shielding effectiveness through the reflection-based mechanism as well as the absorption-based mechanism.



Bio: Prof. Sung-Hoon Kim is a renowned chemist and materials engineer who has largely influenced his field and directly aided in the development of new chemical synthesis methods and novel nanomaterials. Dr. Kim received a Ph.D. in Chemistry in 1993 from Seoul National University in South Korea. Additionally, Dr. Kim went on to earn another Ph.D. in Advanced Electronics & Optical Science in 2005 from Osaka University in Japan. From 1988 to 1998, he was a Senior Researcher in the New Materials Laboratory of Samsung Advanced Institute of Technology (SAIT). In 1996, he was also an Adjunct Research Associate in the Materials Research Laboratory of The Pennsylvania State University in the United States. Dr. Kim's experience also includes being a Visiting Scientist in the Division of Advanced Electronics & Optical Science at Osaka University in 2000 and 2001. Subsequently, he worked as a Researcher/Ronpaku Fellow at Osaka University from 2001 to 2005. Dr. Kim was also a Visiting Scientist in the Department of Materials Science & Engineering at North Carolina State University in the United States from 2001 to 2003. Since 1998, Dr. Kim has been a Full Professor in the Department of Engineering in Energy & Applied Chemistry at Silla University in South Korea. He is now the Director of Industry-Academy joint Small Bussiness Center in Silla University.

Dr. Kim's career is marked by a multitude of pioneering contributions to the field of chemistry and materials, specifically in the areas of diamond thin films and carbon nanomaterials. Dr. Kim has not only developed novel methodologies to produce diamond thin films and carbon materials, but he has revolutionized their application in electronic products. For instance, he took advantage of the lubrication properties of diamond-like carbon (DLC) films to improve VCR heads. DLC components behave as lubricant components that protect the VCR film. Dr. Kim patented this astounding application of diamond-like films in Korea, Japan, and the U.S. The electronics giant Samsung incorporated his diamond-like film technology to its Samsung VCR Head, which became the commercially successful Samsung Diamond Head VCR.

Plenary Speech III:

Prof. Alfred A.Christy (University of Agder, Norway)

Water Adsorption Properties of Malto-Oligosaccharides and Cyclodextrins Studied by near Infrared Spectroscopy and Gravimetry

The adsorption properties of water molecules on malto-oligosaccharides and cyclodextrins are attributed to the OH groups of the glucose rings in the molecules. The water molecules are adsorbed onto OH groups by hydrogen bond formation. Near infrared spectroscopic and gravimetric techniques were used in analysing the adsorption characteristics of malto-oligosaccharides and cyclodextrins. Near infrared spectra of the dry malto-oligosaccharides and pure dry cyclodextrins were measured by using a Perkin Elmer Spectrum one NTS FT-NIR spectrometer equipped with a transflectance accessory and a DTGS detector at a relative humidity of 50%. The amounts of water adsorbed by the samples were also recorded by an analytical balance. Second derivative techniques were used in decomposing the OH combination frequency of the adsorbed water molecules in the region 5300-5000 cm^{-1}. The results indicate that the water molecules are adsorbed on to C2 and C3-OH groups at a higher rate compared to the adsorption onto C1-OH groups in the oligosaccharides. Adsorption also takes place onto the ethereal oxygen atoms in the glucose rings. The gravimetric results show that the adsorption of water molecules increases with the number of glucose units in the malto-oligosaccharides except maltotriose which has the highest adsorption over a period of 75 minutes. Among Cyclodextrins. the β-cyclodextrin behaves differently compared to the other two cyclodextrins. The βcyclodextrin adsorbs and acquires water through the C6-OH and C2, C3-OH groups and diffusion processes from the start. The other two cyclodextrins use their primary and secondary OH groups in adsorbing water molecules in the initial stages and through a slow diffusion process at latter stages.

Bio: Prof. Alfred A. Christy obtained his primary and secondary education from St. Patrick"s College Jaffna. He entered the then University of Ceylon (Peradeniya) and obtained a Bachelor degree in Chemistry (B.Sc., University of Peradeniya, 1976). The first position held by Professor Christy was as a Demonstrator/Assistant Lecturer in Chemistry at the University of Jaffna in Sri Lanka (1976-1977). He then moved to Nigeria, where he worked first as a teacher and then as senior master in Chemistry at a local college (1977 - 1983) in Ondo State, Nigeria. He then moved to Bergen, Norway. In Bergen, he commenced furthering his education at the University of Bergen, while acting as a teaching assistant (1983-1987) and then as lecturer at the Department of Chemistry (1987-1991). He was awarded a master degree in Physical Chemistry in 1987 and Dr. Scient. Degree in 1990. He then worked first as a research Scientist (1991-1992) and later as a laboratory manager/research scientist in the FT-IR laboratory he built up at the department (1992-1998). He assumed a professorship in Chemistry at the Department of Chemistry, University of Agder in 1998.

Professor Christy has accumulated an impressive list of scientific achievements during his career. He has published over 100 papers in scientific journals and presented more than 90 lectures at conferences, institutions of higher learning and industrial establishments around the world. Professor Christy has authored several book chapters and reports. He co-authored a book entitled "Modern Fourier transform Infrared Spectroscopy" (A. A. Christy, Elsevier-2001). He has also been a co-editor of a second book "NIR spectroscopy in Food Science and Technology" (Wiley, 2006). The breadth and depth of this work is well seen in the fact that Professor Christy has acted as a referee for some 25 different International Journals across a wide spread of disciplines related to chemistry.

Professor Christy's international standing earned him respect in his discipline and this fact is clearly reinforced by his appointment in the "Research Proposal Reviewer" for the National Science Foundation-Division of Earth Sciences, Instrumentation and facilities Program, USA. Furthermore, Professor Christy has been included in the "Marquis who's who in the world" and several other directories from 1991onwards. He has also received several awards such as "Man of the Year 1994", "20th Century Achievement Award (1995)" and several other honours such "Five hundred leaders of influence in the world". Prof. Christy chaired the “First Scandinavian Conference on Fourier Transform Infrared Spectroscopy” in 1994. Since then he has been in the steering committees of several international conferences in Chemistry and material science.

Prof. Christy has also been involved in International education as a Consultant & Co-ordinator for students in Norway, training Science teachers in Uganda on behalf of U.N.; serving in the scientific Committees for evaluating PhD theses from Universities in Pakistan and as an adviser and visiting professor at the University of Petroleum (Beijing) and Thammasat University in Thailand to name a few.

Plenary Speech IV:

Prof. Takahiro OHASHI (Kokushikan University, Japan)

Dissimilar Materials Joining Utilizing Friction-Sir Forming Approach

It is expected that the material ratio of steel for an automobile will decrease rapidly in next decade due to the rise of electric vehicles, and multi-materialization of parts will be promoted consequently. Hence, technologies for dissimilar materials joining have been studied by researchers successfully. The authors have studied dissimilar materials joining with utilizing friction-stir forming (FSF) approach. The FSF is a friction-stir process invented by Nishihara in 2002. In FSF, a substrate material was put on a die firstly. Next, friction stirring was conducted on the back surface of the material. The material then deformed and filled the cavity of the die due to high pressure and heat caused by the friction stirring. The authors utilized the FSF approach to generate mechanical joints between dissimilar materials. In this presentation, the author ntroduces methodologies for joining dissimilar materials with employing the FSF, i.e. fastenerless-riveting and easily-separating joining with considering recycling. In addition the author demonstrates some examples of dissimilar joining between aluminum alloy and steel and aluminum alloy and CFRP.

Bio: Professor Takahiro Ohashi is Head of Mechanical Engineering Department at Kokushikan University. He is one of reprehensive delegates of Japan Society of Technology of Plasticity from 2016 to now, and he is the board of trustees of Association of Aluminum Forging Technology in Japan. He was experienced in directing 3 research teams of Digital Manufacturing Research Center of National Institute of Advanced Industrial Science and Technology (AIST).

Program at a Glance

Day 1---Jan. 20, 2018 (Saturday)

South Foyer@2F	
Registration Note: *Collecting conference materials *Certificate will be get at the end of each session. *Accommodation not provided, and suggests making an early reservation.	**9:30-17:00**
First Meeting Room	
Opening Remarks:	**13:00-13:05**
Keynote Speech I: **Prof. Ando Tatsuo** (The University of Tokyo) "Fire Safety of Polymer-Based Building Materials and Test Methods in Japan"	**13:05-13:55**
Keynote Speech II: **Prof. Alan Kin-tak Lau** (Swinburne University of Technology) "Structural Performance and Health Monitoring of Polymer-based Composites at Harsh Environment"	**13:55-14:45**
Coffee Break & Group Photo ***Session P-1***	**14:45-15:25**
Plenary Speech I: **Prof. Yufeng Zheng** (Kumamoto University) "New Directions and Technologies for Metallic Biomaterials"	**15:25-15:55**
Plenary Speech II: **Prof. Sung-Hoon Kim** (Silla University) "Controllable synthesis of carbon coil hybrid materials and their shielding effectiveness for the electromagnetic wave radiation"	**15:55-16:25**
Plenary Speech III: **Prof. Alfred A. Christy** (University of Agder) "Water Adsorption Properties of Malto-Oligosaccharides and Cyclodextrins Studied by near Infrared Spectroscopy and Gravimetry"	**16:25-16:55**
Session P-2	**16:55-17:35**
Dinner @ ITRI ITO Restaurant	**18:00-19:00**

Day 2---Jan. 21, 2018 (Sunday)

<table>
<tr><td colspan="4">South Foyer@2F</td><td></td></tr>
<tr><td colspan="4">Registration
Note: *Collecting conference materials
*Certificate will be get at the end of each session.
*Accommodation not provided, and suggests making an early reservation.</td><td>9:00-17:00</td></tr>
<tr><td colspan="4">First Meeting Room</td><td></td></tr>
<tr><td colspan="4">Opening Remarks:
Prof. Serge Zhuiykov (Ghent University Global Campus)</td><td>9:00-9:05</td></tr>
<tr><td colspan="4">Keynote Speech III:
Prof. Mattheus F. A. Goosen (Alfaisal University)
“Applications of Advanced Materials in Renewable Energy Technologies”</td><td>9:05-9:55</td></tr>
<tr><td colspan="4">Keynote Speech IV:
Prof. Serge Zhuiykov (Ghent University Global Campus)
“Surface Functionalization of Two-dimensional Vertically Aligned Semiconductor Heterojunctions”</td><td>9:55-10:45</td></tr>
<tr><td colspan="4">Group Photo & Coffee Break</td><td>10:45-11:10</td></tr>
<tr><td colspan="4">Plenary Speech IV:
Prof. Takahiro OHASHI (Kokushikan University)
“Dissimilar Materials Joining Utilizing Friction-Sir Forming Approach”</td><td>11:10-11:40</td></tr>
<tr><td colspan="4">Lunch @ ITRI ITO Restaurant</td><td>11:40-12:40</td></tr>
<tr><td>1st Meeting Room</td><td>2nd Meeting Room</td><td>3nd Meeting Room</td><td>5nd Meeting Room</td><td></td></tr>
<tr><td>Session A-1</td><td>Session B-1</td><td>Session C-1</td><td>Session D-1</td><td>12:40-13:55</td></tr>
<tr><td>Session A-2</td><td>Session B-2</td><td>Session C-2</td><td>Session D-2</td><td>13:55-15:55</td></tr>
<tr><td colspan="4">Coffee Break</td><td>15:55-16:10</td></tr>
<tr><td>Session A-3</td><td>Session B-3</td><td>Session C-3</td><td>Session D-3</td><td>16:10-18:40</td></tr>
<tr><td colspan="4">Dinner @ ITRI ITO Restaurant</td><td>18:50-20:00</td></tr>
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Day 3---Jan. 22, 2018 (Monday)

Optional One Day Visit	**9:00-18:30**

Oral Presentation

Date: 21 Jan. 2018(Sunday)

Time: 12:40-18:25

Venue: 1st Meeting Room

Time	
12:40-13:55	**Session A-1:** ***Materials Chemistry and Chemical Engineering***
13:55-15:55	**Session A-2:** ***Electrochemistry and Photoelectrochemistry***
15:55-16:10	*Coffee Break*
16:10-18:25	**Session A-3:** ***Metals and Alloys***

Note:

* Please control each presentation time within 15 mins, including Q & A.
* The certification of Oral presentations, will be awarded at the end of each session.
* Best Presentation of each session is encouraged to award to student author prior.
* Winner of Best presentation will be announced at the end of each session and awarded winner certificate over the banquet on Jan. 21.
* To show respect to other authors, especially to encourage the student authors, we strongly suggest you attend the whole session.
* The scheduled time for presentations might be changed due to unexpected situations, please arrive meeting room at least 10 Mins before your Session starts.
* Session photo will be taken at the end of each session and updated online.

10:55–12:10, Sunday, 21 Jan.

Session A–1: Materials Chemistry and Chemical Engineering

Venue: ***1st Meeting Room***
Chair:

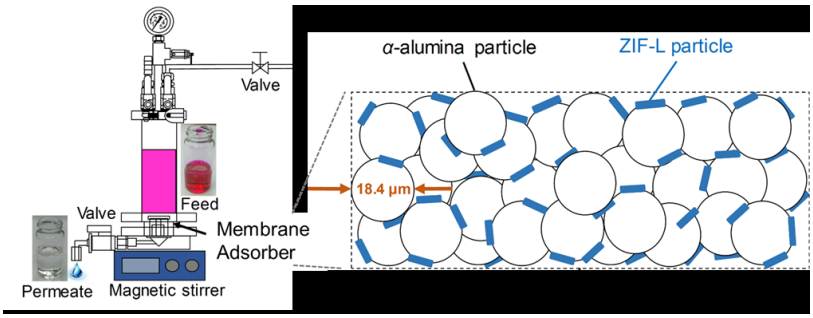
R018-A

Time: 12:40-12:55

Membranes Comprising Metal-Organic Frameworks for Water Treatment

Assoc. Prof. Dun-Yen Kang
National Taiwan University, Taiwan

In recent years, metal-organic frameworks have drawn increasing attention in many research areas [1,2]. However, the applications of MOF on water treatment are still in its infancy. Herein we report on emerging applications of MOFs for water treatment. Specifically, a novel platform, MOF-based membrane adsorber, was developed for sorption of dye molecules in aqueous phase. Two types of MOF (ZIF-8 and ZIF-L) were grown within a porous α-alumina support to form a membrane for the adsorption of the die molecule, Rose Bengal. The surfactant CTAB was used in the synthesis of membrane adsorber in order to optimize the loading of MOF crystals within the membrane. The MOF-based membrane adsorbers exhibited water permeance (104 L/m2/bar/h) far exceeding that of most existing membrane adsorbers.



R051-A

Time: 12:55-13:10

An Effective Route to Transform Coffee Grounds into Activated Carbons with High Adsorption Capacity of Methylene Blue

Mr. Chiang Jhih-Hao, Wang Shun-Bo and Lin Jarrn-Horng
National University of Tainan, Taiwan

Activated carbon (AC) is widely used in the human society and the industry. However, the progressive shortage of the conventional precursors (coal or coconut shell) for generating AC would cause an impact in our living environment. Therefore, how to effectively select the new sources to produce AC is an important issue. Here, we aim to study the use of coffee grounds, a common biomass waste around the world, as a precursor of AC. A three-step treatment (chemical, carbonization and activation) has been developed to effectively transform coffee grounds into highly-pure activated carbons (HP-AC). The as-prepared HP-AC displays a specific surface area of 2574 m2/g (total pore volume of

1.01 cm3/g) with a yield of 14.6 wt%. Adsorption of methylene blue (MB) using HP-AC from aqueous solution under equilibrium and kinetic conditions was evaluated by varying initial MB concentration (0.15–60 ppm), contact time (0–720 min), solution pH (2–12) at 30 ℃. The Langmuir isotherm model shown better fit to the equilibrium results than the Freundlich model. The adsorption capacity (qm) of HP-AC is 638 mg/g. The kinetic adsorption results were well described by the pseudo-second-order model. XPS results reveal that electrostatic interaction between the oxygenated functional groups on HP-AC and MB is suggested as the main driving force for the adsorption process.

R053

Time: 13:10-13:25

Synthesis of Silica Materials from the Slurry Waste

Zih-Yao, Shen, Zhong-Chen, Lu, Yun-Chi, Liu and **Prof. Maw-Tien Lee**
National Chia-Yi University, Taiwan

In solar energy industry, large amount of slurry wastes were produced during the wafer dicing process. The slurry waste contains silicon, silicon carbide and cutting oil. In this study, silicon in the slurry waste was treated with sodium hydroxide to produce a liquid mixture of the sodium silicate. The residue of the reaction was silicon carbide. The liquid mixture was separated to be a sodium silicate solution and used as a silica precursor for producing the silica powder and a hydrophobic silica aerogel by using the sol-gel method. The products were characterized by Fourier transformation infrared spectroscopy (FTIR) and powder X-ray diffraction (pXRD). Experimental results show that the characteristics of the products produced from the slurry waste are similar to that obtained by using the pure sodium silicate solution. It indicates that the wafer dicing slurry waste has a high potential to be a resource for other industries.

R064

Time: 13:25-13:40

Ruthenium Dye (N3) Removal From Simulated Wastewater Using Bamboo Charcoal and Activated Bamboo Charcoal

Dr. Nurul Najihah Binti Rosli, Lim Chee Ming, Abdul Hanif Mahadi, Suthee Wattanasiriwech, Ren Chong Lim, **Dr. N.T.R.N. Kumara**
University Brunei Darussalam, Brunei Darussalam

The presence of heavy metals such as mercury (Hg), cadmium (Cd), arsenic (As), chromium (Cr), thallium (T1) and ruthenium (Ru) in wastewater, even in trace quantities, could cause a negative impact on our health. The adsorption method has been proven to be the most effective and low-cost method for removing of heavy metals from wastewater. In this study, biomass waste was used as a low-cost precursor for the production of cost-effective charcoal and activated carbon. Solid waste from a common local bamboo species (Gigantochloa sp.) was used to produce charcoal and activated carbon. The simulated wastewater was made with Ruthenium complex (N3) dye solution as the adsorbate. The bamboo charcoal was prepared by carbonization, and activated carbon was prepared by NaOH activation after carbonization. The morphological characteristics, chemical compositions, and the lattice structures of the prepared adsorbents were analyzed using SEM, EDX, and XRD. The adsorption performance of the prepared adsorbents toward N3 dye was evaluated, and the highest adsorption capacity of 1.50 mg/g was obtained from activated carbon. The results showed that the activated bamboo-based charcoal has a better adsorption efficiency when compared to the bamboo charcoal for the treatment of N3 dye in wastewater.

EM003

Time: 13:40-13:55

Utilization of Tobacco Raw Material Into Biofuel

Mr. Abubakar Ahmad, Zahra Syifadeasy Azkya and Moehammad Fauzi
Universitas Padjadjaran/Agroindustrial Technology, Indonesia

As the fifth largest tobacco market in the world, most of the tobacco raw material in Indonesia is utilized for cigarette production. People still unfamiliar with the notion of utilizing tobacco leaves for another purpose. This paper will try to propose a new way to derive benefit from tobacco leaves into biofuel. The method will be done through literature review. The study was focused on 3 things, mainly the potency of tobacco leaves in Indonesia, obtaining and handling raw material and potential market of biodiesel itself. This research resulted that currently, tobacco need to develop in Indonesia because Indonesia is a potential country in the development of biodiesel, especially biodiesel made from tobacco. We also concluded that biodiesel from tobacco has an advantage in terms of increased productivity of oil and biodiesel from tobacco mixed by ordinary diesel can produce lower combustion emissions and improve the performance of diesel engines. Also the market of biodiesel products is still wide open. This market covers the domestic market and international market. In the end of this paper we recomended, the governementt must increase the socialization of the benefits tobacco oil, more tobacco biodiesel industry investment, the new tax policy on tobacco biodiesel and create research agreement with Pertamina or other petroleum industries to build biodiesel industry of tobacco in national scale or international scale.

13:55–15:55, Sunday, 21 Jan.

Session A–2: Electrochemistry and Photoelectrochemistry

Venue: ***1st Meeting Room***
Chair:

R022

Time: 13:55-14:10

Mg-La co-doped TiO2 as Compact Layer for High Efficient Dye-Sensitized Solar Cells

Dr. Piyasiri Ekanayake, Alwani Imanah Rafieh, Norhafillah Mohammad Thamrin and Lim Chee Ming

A compact layer of TiO_2, between FTO and mesoporous TiO_2 layer of DSSC anode, has the ability to reduce the electron recombination while mesoporous TiO_2 layer functions to collect and transport electrons injected by the photoexcited dye. In enhancing the desired functions of compact and mesoporous TiO_2, we study the effects of co-doping it with Mg, Eu, and La. MgLa co-doped TiO_2 as compact layer has demonstrated higher efficiency due to its increased oxygen vacancies and smaller particle size which results reduced recombination. The combination of pure and co-doped TiO_2 nanoparticles to be selected as either compact or mesoporous layer of DSSC anode depends on their respective properties, as demonstrated in this paper.

R057

Time: 14:10-14:25

Synthesis and Characterization of Sm1-xZrxFe1-yMgyO3 (x, y = 0.5, 0.7, 0.9) as Possible Electrolytes for SOFCs

Abdalla M. Abdalla, Shahzad Hossain, Nikdalila Radenahmad, Pg M.I. Petra, Mahendra R. Somalu, Seikh M. H. Rahman, Sten G. Eriksson, **Dr. Abul K. Azad**
Universiti Brunei Darussalam, Brunei Darussalam

The novel perovskite oxide series of $Sm_{1-x}Zr_xFe_{1-y}Mg_yO_3$ (x,y = 0.5, 0.7, 0.9) were synthesized by solid state reaction method. X-ray diffraction (XRD), Rietveld refinement, scanning electron microscopy (SEM), electrochemical impedance spectroscopy (EIS) and conductivity analysis were carried out. XRD patterns of sintered materials revealed the shifted Bragg reflection to higher angle for the higher content of Zr and Mg. This is related to the ionic size of the dopant elements. Rietveld refinement showed that all compounds crystallized in cubic space group of F*m-3m*. SEM images showed that the grains were well defined with highly dense surfaces makes it potential as an electrolyte material in solid oxide fuel cells (SOFCs) or gases sensors. Impedance spectroscopy at 550-800 ℃ shows that conductivity is higher at higher temperature. $Sm_{0.5}Zr_{0.5}Fe_{0.5}Mg_{0.5}O_3$ shows the highest conductivity of 5.451×10^{-3} S cm^{-1} at 800 ℃. It was observed that 50% molar ratio of Mg and Zr doping performed highest conductivity.

R1020-A

Time: 14:25-14:40

The Role of Substrate for Oxygen Deficient BiVO4 photoanode in Photoelectrochemical Water Splitting

Mr. Jie-Wen Chen and Ying-Chih Pu
National University of Tainan, Taiwan

BiVO4 photoanodes represented a great potential for the application in Photoelectrochemical (PEC) water splitting to produce the clean energy, hydrogen. In addition, the oxygen vacancy can be created by reduction to suppress the fast charge recombination, leading to improve the PEC performance. However, the effects of the interface between substrate and BiVO4 are rarely investigated. In this study, we utilized the different ways, including electrochemical, chemical and hydrogen treatments to create the oxygen vacancy in substrate, doped tin oxide (O-FTO). The BiVO4 layer was subsequently deposited on O-FTO. Afterword, X-ray diffraction (XRD), scanning electron microscope (SEM), transmission electron microscope (TEM), X-ray photoelectron spectroscopy and ultraviolet photoelectron spectroscopy were used to detail characterize the crystal structure, morphologies, and surface properties of obtained samples. After the comparison the PEC performance of bare BiVO4/FTO, BiVO4/O-FTO and oxygen deficient (OD) BiVO4/FTO photoanodes, the results indicated an interesting result that both of the OD-BiVO4/FTO and BiVO4/O-FTO showed the higher efficiency than bare BiVO4/FTO. In addition, the PEC results also revealed that the half of the overall improvement for PEC water splitting was contributed from the O-FTO. Consequently, we further studied the charge carrier transfer behavior at the interfacial between BiVO4 and O-FTO to understand the detail mechanism, which indicated that the oxygen vacancy of FTO play an important role to boost the electron transfer from BiVO4 to O-FTO to improve the efficiency of photoelectrical conversion. The current study demonstrated that the interface between BiVO4 and FTO substrate play an essential role to effect charge transfer, as well as the efficiency of PEC water splitting.

R1019-A

Time: 14:40-14:55

CuInSx-Quantum Dot Sensitized Optimized TiO2 Nanowire Photoanode for Solar Fuel Generation

Mr. Yu-Lin Chen and Ying-Chih Pu
National University of Tainan, Taiwan

Titanium dioxide (TiO_2) nanowire (NW) has been widely use a photoanode in Photoelectrochemical (PEC) water splitting because of its suitable redox potential, chemical stability, and low fabrication cost. Based on the theoretical calculation, the photocurrent density of the TiO_2 NW photoanode in PEC water splitting was about 2 mA/cm^2 under the one sun illumination, while the performance of pure TiO_2 NW without any further treatment didn't achieve the theoretical value in the most reported literatures. Herein, we developed the optimization process of TiO_2 NW through the modulation of seed layers on doped tin oxide (FTO) substrate. Interestingly, the optimized TiO_2 seed layer coating could effectively improve the performance above 2-fold of TiO_2 NW to close the theoretical value in PEC water splitting. Furthermore, we utilized successive ionic layer adsorption and reaction (SILAR) and chemical bath deposition (CBD) methods to decorate CuInSx quantum dots (QDs) on the surfaces of bare and optimized TiO_2 NWs for PEC hydrogen (H_2) generation. Similarly, the CuInSx QDs decorated on optimized TiO_2 NWs represented better efficiency in H_2 generation than bare TiO_2 NWs, which was majorly attributed to the higher surface area and better charge transport properties of the optimized TiO_2 NWs. Therefore, the current optimization method can not only effectively to improve the efficiency of QD sensitized TiO_2 NWs in the application of PEC H_2 generation, but also applied to other metal oxide photoanodes for photoelectrial conversions.

R063

Time: 14:55-15:10

Corrosion of Fe3Al-4Cr Alloys at 1000 oC in N2-0.1%H2S Gas

Yuke Shi, **Mr. Dong Bok Lee**
Sungkyunkwan University, South Korea

Pure Fe3Al and Fe3Al+4%Cr alloys were corroded at 1000 oC for up to 200 h in N2-0.1%H2S-mixed gas in order to study their corrosion behavior in H2S-containing atmosphere. The formed scales consisted primarily of α-Al2O3, FeAl2O4, and Fe2O3. In these oxide scales, hydrogen and sulfur dissolved according to the reaction; H2S→2H+S. Corrosion products of Cr were not identified in the scales from the XRD analysis, indicating that Cr dissolved in the oxide scales. Fe3Al+4%Cr alloy displayed poorer corrosion resistance than Fe3Al alloy, indicating that chromium accelerated the corrosion rates of Fe3Al alloys.

R097

Time: 15:10-15:25

Hydration Chemistry of Cement Studied by Near Infrared Spectroscopy

Ms. Thitarat Prathumsuwan, Alfred A. Christy, and Rein Terje Thorstensen
Thammasat University, Thailand; University of Agder, Norway

Cement is a complex mixture of inorganic compounds which mainly composed of calcium silicates and calcium aluminates. Cement is mixed with water to form concrete. During the mixing calcium silicate hydrate (CSH) and calcium hydroxide are formed. The ratio of water/cement (w/c ratio) is important to obtain a mixture that gives optimum strength to the concrete. In this work, three different cement samples were mixed with water in four different ratios, including 0.35, 0.40, 0.45 and 0.55, respectively. The hydration process of cement was investigated by using near infrared (NIR) spectroscopy over a period of 28 days. The combination frequency of OH stretching and bending of water molecules gives rise to an absorption around 5200 cm^{-1}. This peak contains contributions of overtones from several types of water molecules in the cement. Fourth derivatives spectra of all cement samples showed three peaks in the combination band region of 5300-5100 cm^{-1}. These peaks indicated the presence of three distinct types of water molecules in the system. First, the characteristic peak at 5260-5240 cm^{-1} represented the hydrogen bond between water molecules and silinol group of calcium silicates. This peak indicated the formation of CSH from hydration of cement. Furthermore, this peak experienced a slight red shift after a period of seven days indicating stronger hydrogen bonding of water molecules with silinol groups. The peak at 5130 cm^{-1} corresponded to hydrogen bonding between water molecules and the peak at 5165 cm^{-1} corresponded to hydrogen bonding between free water and bound water. The suitable w/c ratio for cement-1 is at 0.35-0.45, cement-2, and cement-3 are 0.45. In addition, real concrete sample showed two characteristic peaks at 5250 cm^{-1} and 5165 cm^{-1}, demonstrating the presence of CSH and free water within concrete, respectively. Near infrared spectroscopy in combination with fourth derivative technique can be used to investigate the hydration chemistry of cement and concrete.

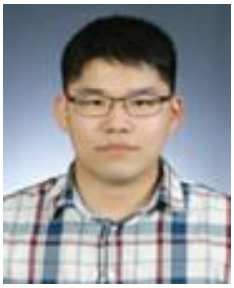
R098

Time: 15:25-15:40

Quantitative Determination of Calcium Hydroxide by Using Near-Infrared Spectroscopy

Ms. Tanyapa Sangpongpitthaya, Alfred A. Christy and Rein Terje Thorstensen
Thammasat University, Thailand; University of Agder, Norway

Calcium hydroxide (CH) is a by-product from hydration reaction of cement along with calcium silicate hydrate (C-S-H) gel. It helps to protect the steel reinforcements in concrete structures from corrosion process due to carbonation. The presence of calcium hydroxide provides a basic environment (pH>10) that induces the formation of passive oxide film and keeps steel structures from corrosion. The detection and quantification of calcium hydroxide in concrete structures are important to understand the nature and state of the steel structures in concretes. In this research work, the variation of calcium hydroxide to calcium silicate ratios in cement were measured by using near-infrared spectroscopy (NIR). The first overtone of the OH groups in calcium hydroxide absorbs at 7082 cm^{-1} and this n absorptio peak can be used as a quantitative measure of calcium hydroxide in samples. Correlation plot between second derivative absorbance intensity at 7082 cm^{-1} with different mixtures of calcium hydroxide in calcium silicate base. The amount of calcium hydroxide in calcium silicate base was established. This calibration plot was used as basis for determining calcium hydroxide content in unknown concrete samples. Concrete samples for the quantitative determination of calcium hydroxide were prepared from standard cement samples and cement samples with or without pozzolan along with various water to cement ratios. The results show that all samples analyzed in this work contain calcium hydroxide in varying amounts. This variation reflects the composition of the cement and concrete samples.



EM005-A

Time: 15:40-15:55

Study on Double Perovskite as a Solid Oxide Regenerative Fuel Cell Cathode

Mr. YoungJin Kwon, Jong-woo Lee, Juhee-Kim, Sam-hyeon Yoo
Korea Military Academy; Korea Advanced Institute Science and Technology, Korea

It has been increasing interest in hydrogen(H2) as an alternative energy carrier. Because the H2 has high energy density, pure emission and it is easy to be transported by using a pipeline. But H2 doesn't exist on the earth as a fuel. For this reason, it must be generated. There are several ways of producing H2 such as by photocatalytic water splitting, gasification of biomass, solar thermochemical water splitting and water electrolysis driven by solar cell or wind turbine. Among these technologies, Solid oxide regenerative fuel cell(SORFC) is a practical and efficient method for the industrial field. High operating temperature improves the electrode kinetics and reduce the SORFC electrolyte resistance, leading to lower losses in cell performance.

Due to similarity to Solid oxide fuel cell(SOFC), advances have been made in the development of SORFC based on cell assemblies with structure nickel-yttria stabilized zirconia(Ni-YSZ) fuel electrode / YSZ electrolyte / lanthanum strontium manganite-YSZ(LSM-YSZ) air electrode. The previous study show that the performance discrepancies of the cell in operation between the electrolytic and galvanic modes could be varied, depending on the electrode materials. Moreover, the Ni-YSZ most widely used fuel electrode has several problems even though its great catalytic performance. One of them is degradation of the fuel electrode because of Ni particle's redox reaction and agglomeration. Therefore it is necessary to develop an alternative fuel electrode material.

Double perovskite electrode material is one of the promising candidate for the fuel electrode of the SORFC because of its high catalytic performance and stability at SOFC mode. In this

study, We studied on the Double perovskite Pr0.5Br0.5MnO3-δ(PBMO) as a fuel electrode material of SORFC. PBMO was infiltrated into the scaffold structure of the electrolyte, La0.8Sr0.2Ga0.85 Mg0.15O3-δ (LSGM) and synthesized at the low temperature because second phase generated when it annealed at high temperature. The Half cell test was conducted to investigate the electrochemical performance of the electrode material at the steam rich atmosphere.

Coffee Break

15:55-16:10

16:10–16:45, Sunday, 21 Jan.

Session A–3: Metals and Alloys

Venue: *1st Meeting Room*

Chair:

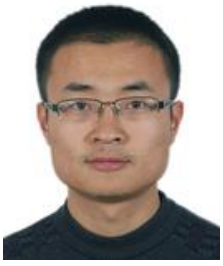
R2009-A

Time: 16:10-16:25

Evolution Behavior of γ' phase in a Nickel Base Superalloy by High Current Density Electropulsing

Prof. Lei Wang, Yang Liu, Xiu Song And Jilan An
Northerstern Univerisity, P. R. China

A nickel base superalloy was treated by high current density electropulsing. The microstructures and evolution behavior of γ' precipitates in alloys by electropulsing and aging treatments were investigated by laser scanning confocal microscope (LSCM) and transmission electron microscopy (TEM). The results show that the growth rate of γ' by high current density electropulsing is increased obviously compared with that by aging at the same temperature. The γ' coarsening kinetics by high current density electropulsing follows the LSW theory. The value of activation energy for γ' coarsening by electropulsing is 89.86 kJ/mol, it is about 64.31% reduced compared with that by aging (251.84 kJ/mol). Since the electropulse can accelerate the atomic thermal vibrations, make the atoms be in high energy state, the activation energy for atomic transition during the high current density electropulsing will be decreased. On the other hand, the thermal stress induced by the transient temperature rising on the early stage of electropulsing increases the vacancy concentration, accelerates the atom diffusion, and therefore promotes the coarsening of γ' phase.



R007

Time: 16:25-16:40

Micromechanical Study of the Forged Ti-1023 Titanium Alloy by Micro-Indentation

Dr. Jiang Li, Fuguo Li, Xinkai Ma, Mingjie Zhang and Zhanwei Yuan
Northwestern Polytechnical University, P.R. China

In order to study the m icromechanical behaviour of the forged Ti-1023 titanium alloy, micro-indentation experiments of the forged Ti-1023 titanium alloy were performed with various maximum indentation loads from 500 mN to 4000 mN and various loading speeds from 5.06 mN/s to 51.85 mN/s. Using the experimental data, the non-destructive instrumental approach was applied to indicate the mechanical properties just like the Young's modulus E, microhardness H, initial yield stress σ_y and strain hardening exponent n using the P-h curves from the tests. The result showed that the value of the indentation Young's modulus basically remain unchanged in the range from 110 GPa to 150 GPa and H decreased with the increase of the load, the micro-indentaion plasticity constitutive equations were obtained by using Hookean elastic and power-law plastic stress-strain equations.

R3001

Time: 16:40-16:55

Effect of Tantalum (Ta) Addition to Zinc-Aluminum Alloy 5 (ZA5) on its Microstructure and Fatigue Life

Adnan. I.O. ZAID and **Dr. Dua.O. WERAIKAT**
Rochester Institute of Technology- NY, Dubai, UAE

Due to their resistance to wear and corrosion, the use of Zinc-Aluminum (Zn-Al) alloys in general and Zinc-Aluminum 5 (ZA5) alloys, in particular, have spread in the last two decades in industrial applications. These alloys normally solidify in a coarse dendritic structure which affects their surface quality and mechanical behavior. Therefore, their structure is normally refined by rare earth materials, such as Titanium (Ti), Titanium-Boron (Ti-B) or zirconium (Zr). In this research, the effect of adding Tantalum (Ta) to ZA5, at the following percentages: 0.02%, 0.04%, 0.06%, 0.08%, and 0.10%, on its microstructure and fatigue life is investigated. The results of this work revealed, within the experimental range, that the addition of Ta as a grain refiner at all rates could change the coarse dendritic structure of ZA5 into a fine nodular one. It was also found that adding Ta at 0.04% to ZA5 increased its fatigue life at a stress level of 160 MPa. However, adding Ta at a rate percentage higher than 0.04% and at stress level exceeding 160 MPa resulted in deterioration of its fatigue life.

R3004

Time: 16:55-17:10

Corrosion of 310S Austenitic Stainless Steel in Simulated Rocket Combustion Gas

Mr. Tosapolporn Pornpibunsompop, Purit Thanakijkasem
King Mongkut's University of Technology Thonburi, Bangkok Thailand

High temperature corrosion of 310S austenitic stainless steel in simulated rocket combustion gas at 900 degree Celsius was investigated and discussed in this paper. 310S austenitic stainless steel was chosen because it was used for building some components of a rocket launcher. The corrosive atmosphere was prepared by mixing of hydrochloric acid and distilled water with 5.5 mole per liter then, boiling that solution and feeding into a corrosion testing chamber. The chamber was set up at 900 degree Celsius with duration 210 hrs. After testing, the corroded specimen was microscopically characterized by OM and SEM/EDS techniques. The corrosion layer was classified into three main sublayers: peeling-off scale, external corrosion sublayer, and internal corrosion sublayer. The local chemical information was analyzed by XRD (in case of peeling-off scale) and SEM/EDS (in case of external and internal corrosion sublayers). The peeling off scale mainly comprised Fe_2O_3 and $Fe_{21.3}O_{32}$ ferrous oxides because they needed much oxygen consumption to exist. In case of external and internal sublayers, there were a lot of pore tunnels and corrosion products. Chlorine and/or hydrogen chloride would penetrate through a passive film and, then, metal chlorides was formed on both external and internal corrosion sublayers. Metal chlorides would volatile because of their lower evaporation temperature than the testing temperature. Moreover, they were oxidized by oxygen in wet condition and resulted metal oxides mostly remaining on the external corrosion sublayer.

R2010

Time: 17:10-17:25

Microstructure and Mechanical Properties of Equitomic CoCrFeCuNi High Entropy Alloy

Mr. Seung Min Oh, Sun Ig Hong
Chung Nam University, Korea

Microstructure and mechanical properties of cast and cold-rolled equitomic CoCrFeCuNi alloy in which Mn was substituted by Cu from Cantor alloy was studied. The separation into two solid solutions (Cr-Co-Fe rich and Cu-rich phases) were observed in CoCrFeCuNi. Coarsening and widening of interdendritic Cu-rich phase after homogenization was observed after homogenization, suggesting Cu-rich phase is thermodynamically stable. The compressive stress-strain curves of homogenized cast CoCrFeCuNi alloy exhibited the reasonably high strength and excellent deformability for the cast alloy. The yield strength increased up to 960MPa after cold rolling from 265MPa of the homogenized cast alloy. The significant increase of yield strength is thought to be associated with the alignment of Cu-rich second phase in addition to cold work dislocation storage after cold rolling.

R2011

Time: 17:25-17:40

Hot Ductility of Cast High Nitrogen Fe-Cr-Mn-Ni Steel

Dr. Byung Ju Lee, Sun Ig Hong
Chungnam National University, Korea

Hot deformability and fracture of as-cast Fe-Cr-Mn-Ni stainless steel ingots with high nitrogen and high carbon contents were studied. Effective stress-strain curve indicates a decrease of the UTS from 510MPa to 90MPa with increase of temperatures from 600 ℃ to 1200 ℃. Effective stress-strain curves exhibited typical work hardening until the final stage of fracture from 600 ℃ up to 900 ℃. The fracture elongation decreased from 600 ℃ with the increase of temperature up to 850 ℃, but started to increase appreciably as the work softening becomes dominant in the stress-strain curves above 950 ℃. The increase of ductility above 950 ℃ is associated with dynamic recrystallization. The high temperature deformability was enhanced above 1000 ℃ by homogenization of the as-cast alloy due to the dissolution and segregated particles, providing the homogeneous distribution of the nucleation site of dynamic recrystallization. The presence of fatal crack at 1,250 ℃ and the loss of hot ductility can be attributed to the partial melting of as-cast steel at austenite grain boundaries.

R2012

Time: 17:40-17:55

Stress-Strain Responses of Multi-Phase CoCrCuMnNi and CoCrMnFeCu Alloys

Mr. You Bin Kang, Seung Min Oh, Kap Ho Lee and Sun Ig Hong
Chungnam National University, Korea

Stress-strain responses and microstructure of multi-phase CoCrCuMnNi and CoCrMnFeCu alloys in which Fe or Ni was replaced by Cu from Cantor alloy were studied. The deformation mechanisms of CoCrCuMnNi and CoCrMnFeCu were observed to be influenced by the presence of brittle sigma phase and the separated Cu-rich and the matrix phase. CoCrCuMnNi exhibited the relatively lower strength

and excellent deformability, while CrMnFeCoCu alloy exhibited higher strength and lower ductility. The higher strength and the lower ductility of CoCrCuMnNi is associated with the presence more frequent and coarser sigma phase than those in CoCrCuMnNi.

R3005

Time: 17:55-18:10

Relationship between Compressive Residual Stress Relaxation and Microhardness reduction after Cyclic Loads on Shotpeened ASTM A516 Grade 70 Steel

Dr. Mohd Rashdan Isa, Omar Suliman Zaroog, and Fareg S Ali
Universiti Tenaga Nasional, Malaysia

Shot peening process is a cold performed function to enhance the mechanical properties which is widely used in many industries. This process introduces compressive residual stress which was proven to increase the fatigue life, geometry stability and corrosion resistance. However, the benefit of the residual stress is still unstable due to the relaxation during the operation. This paper will study on the trend of the relaxation of residual stress against cyclic loading as well as the change in the hardness. The material used in this study is carbon steel ASTM A516/ SA 516 Grade 70. Shot peening process with steel shots was applied to the samples to introduce compressive residual stress in the samples. Cyclic load was applied to samples after shot peening process with low load of 52Mpa (20% of Yield Strength) and high load of 208Mpa (80% of Yield Strength). The measurement of residual stress using X-Ray diffraction and hardness test was done on the samples to study the trend of the relaxation of residual stress and the change in hardness values. The result shows that more relaxation of residual stress occurs if the applied cyclic load is higher. The change of hardness trend is found non-sequenced in this study due to random coverage of shot peening.

R1015

Time: 18:10-18:25

Numerical Analysis of the Effect of Spot Superposition on Laser Peen Forming of Aluminum Alloy Sheet

Dr. Pei Xu, Zhang Yongkang, Sun Guifang, Ni Zhonghua, Su Boyong, Zhu Ran, Wu Jianhua
Southeast University, China

In order to study the effect of laser spot superposition on aluminum alloy sheet forming by laser peening, the finite element analysis method was introduced to simulating the forming of 7075 aluminum alloy with different spot superposition case. The results showed that the forming effect and stress distribution of the metal sheet was effected by the laser spot superposition modes. The forming effect of transverse spot superposition mode was better than the other three spot superposition modes.

Dinner@ *ITRI ITO Restaurant*

18:50-20:00

Date: 21 Jan. 2018(Sunday)

Time: 12:40-13:55

Venue: 2st Meeting Room

Time	
12:40-13:55	**Session B-1: *Metal Processing and Surface Engineering***
13:55-15:55	**Session B-2: *Electrochemistry and Photoelectrochemistry***
15:55-16:10	*Coffee Break*
16:10-18:40	**Session B-3: *Building Materials***

Note:

* Please control each presentation time within 15 mins, including Q & A.
* The certification of Oral presentations, will be awarded at the end of each session.
* Best Presentation of each session is encouraged to award to student author prior.
* Winner of Best presentation will be announced at the end of each session and awarded winner certificate over the banquet on Jan. 21.
* To show respect to other authors, especially to encourage the student authors, we strongly suggest you attend the whole session.
* The scheduled time for presentations might be changed due to unexpected situations, please arrive meeting room at least 10 Mins before your Session starts.
* Session photo will be taken at the end of each session and updated online.

12:40–13:55, Sunday, 21 Jan.

Session B–1: Metal Processing and Surface Engineering

Venue: ***2nd Meeting Room***
Chair:

R1010

Time: 12:40-12:55

Calculation Method of Curvature Radius and Bending Deformation of Titanium Alloy under multiple Laser Shocks

Dr. Ran Zhu, Yongkang Zhang, Guifang Sun, Pu Li, Boyong Su, Xu Pei, Yong Zhao, Jianyun Huang
School of Mechanical Engineering, Southeast University, China

TC4 titanium alloy plate was processed under multiple laser shocks and bending deformation was studied. A method was proposed to determine the curvature radius of bending deformation of metal plate under multiple laser shocks based on the theoretical model of curvature radius of bending deformation and the eigenstrain field was calculated by a modified finite element analysis method. Effect of shock wave peak pressure and the number of impacts on the curvature radius was studied. Results show that bending deformation increases rapidly at the beginning and then it stops growing. Bending deformation increases rapidly with the increase of the number of impacts and it cannot increase after three impacts.

R1026

Time: 12:55-13:10

Effect of Zirconium Addition on Chemical Corrosion Resistance of Aluminum Grain Refined by Titanium in Acidic and Alkaline Solutions

Prof. Adnan I.O. ZAID and Nader A. B. AL T HEEB
University of Jordan, Amman, Jordan

In this paper, the effect of some grain refiners on the chemical corrosion resistance of commercially pure aluminum was investigated. Three micro alloys and aluminium specimens were tested in Hydrochloric acid solutions and in sodium hydroxide solutions. It was found that addition of either Ti or Zr to aluminum resulted in enhancement of its corrosion resistance in hydrochloric acidic solutions giving higher resistance in case of Zr addition; the average enhancement percentage was 17.3% and 25.4% respectively. However, addition of both Ti and Zr together resulted in deterioration of its corrosion resistance by an average of 10.7%. This reflects that their effect regarding corrosion resistance is not additive. Regarding the addition of these refiners on the corrosion resistance of aluminium in sodium hydroxide alkaline solutions, it was found that addition of either Ti or Zr alone resulted in deterioration of its corrosion resistance, within the concentration levels tested in this work. The average deterioration percentage was 9.6% and 15.5% respectively. In case of addition of Ti and Zr together below 0.1 molarity resulted in enhancement of its corrosion resistance by an average of 3.05%, and resulted in deterioration above 0.1 molarity by an average of 5.7%.

R3010

Time: 13:10-13:25

Effect of Sandblasting Process on Mechanical Properties of ASTM A516 Grade 70 Steel

Mohd Rashdan Isa, **Dr. Omar Suliman Zaroog**, Muhammad Aiman Yunus, Vignesh Rao Sanny Bavu, and Norzulhilmi Rosmi
Universiti Tenaga Nasional, Malaysia

Sandbalsting is a method used for surface treatment and at the same time this process also improves the mechanical properties of the material. ASTM A516 Grade 70 is widely used in industrial sector as it provides very good mechanical properties in tough conditions. The main usage of this material is in moderate and low operating services. This paper focus on the effect of sandblasting process on ASTM A516 Grade 70 on improving the mechanical properties and fatigue life of this material. Samples have been blasted with sand grade SAE G-80. The focus of this paper is the result of the microhardness, tensile and fatigue test before and after the sandblasting process to study the improvement in mechanical properties as well as the fatigue life. The research was extent to the microstructure analysis using SEM to study the change in microstructure after sandblasting process and fatigue test. Result shows that the hardness increases with respect to blasting time. Result also shows 2.3% increment in tensile strength after sandblasting and there is significant increment in fatigue life. Result also shows that the sandblasting process decreases the grain size of the material. It was proven that the sandblasting process will increase the hardness and decrease the grain size of the material with respect to sandblasting time. At the same time, there is a significant improvement in mechanical properties and fatigue life by applying sandblasting process on the tested material.

R060

Time: 13:25-13:40

Evaluation for Chaos in EDM Generated Surface Topography

Mr. Ushasta Aich, Simul Banerjee
Mechanical Engineering Department, Jadavpur University, India

Machined surface carries the inherent features of machining process. Investigation of surface topography generated by machining process is helpful to extract the features of surface development process. In the present study, roughness profiles measured on machined surface generated by EDM are considered as time series and used for extraction of inherent features of surface topography through phase space reconstruction. Presence of self-similarity in surface topography is assessed by estimating a second order fractal dimension, called as correlation dimension. Saturation of correlation exponents with the increase of embedding dimension indicates the presence of chaos in surface topography.

R074

Time: 13:40-13:55

CVD Technology for Preparing Chromium Oxide Coatings, Study of the Kinetics of Growth of Coatings

Dr. Taha Tabaza, Omar Tabaza, Amjad Al-Sakarneh
Amman – Jordan

Metal coating nowadays is very essential in heavy industry and many other

applications, however, a coating system is designed and built to obtain pyrolytic Chrome-Oxide Cr_2O_3, so oxygen is distributed through the coating in order to enhance its properties depending on metal-organic compounds (MOC). A very large number of experiments have been performed to study the effect of oxidant comparing with inert atmosphere. A chemical vapor deposition method for preparing chromium oxide Cr_2O_3 coatings from bis-arene chromium compounds has been performed, followed by studying the effect of oxidant substances concentration on the kinetics of growth of coatings. The main finding is that coatings exhibit excellent adhesion, high microhardness, and wear resistance. The coating process is characterized by high adaptability and relatively low cost.

13:55–15:55, Sunday, 21 Jan.

Session B–2: Electrochemistry and Photoelectrochemistry

Venue: ***2nd Meeting Room***
Chair:

R027-A

Time: 13:55-14:10

Mechanical Properties of Carbon-Fiber-Reinforced Sandwich Panels and Cylinders with Bi-Directionally Corrugated Cores

Dr. Biao Liu, Prof. Yuguo Sun
Harbin Institute of Technology, China

Bi-directionally corrugated sandwich structures have aroused considerable research interests in recent years as a promising alternative to honeycomb sandwich structures for astronautic applications. In this paper, carbon fiber reinforced composite (CFRC) bi-directionally corrugated sandwich panel (BCSP) and cylinder (BCSC) were designed and fabricated. The cores are made up of bi-directionally corrugated cores through pre-folding CFRC prepregs and hot-press molding method. We conducted uniaxial compression tests on BCSCs to explore the load capacity and failure modes. Free vibration experiments were carried out to investigate the vibration behavior of BCSPs and BCSCs. Natural frequencies and vibration modes of BCSPs and BCSCs were revealed by experiments and numerical simulation for the first time. The influence of mass ratio and fiber orientation of bi-directionally corrugated core were studied. Compared with uni-directionally corrugated sandwich panel (UCSP) and cylinder (UCSC), BCSP and BCSC of the same weight and dimension always has higher primary frequency, indicating that bi-directionally corrugated sandwich structure is much stiffer and could be designed even lighter in astronautic applications.

R033-A

Time: 14:10-14:25

Thermal and Mechanical Properties of Copper-Graphite-CNF Composite

Mr. You Han Sohn and **Prof. Jun Hyun Han**
Chungnam National University, South Korea

In recent years, electronic devices have become more functional, lighter, and smaller. As a result, the heat generated by the devices is rapidly increasing. Therefore, the importance of the heat sink or heat spreader is further increased, and a lot of research is being conducted for the development of a heat sink or heat spreader having a high thermal conductivity. Pure copper has high thermal conductivity, but not only has high density and large thermal expansion coefficient, but also low mechanical strength. Therefore, it is not suitable for use as a heat sink of an electronic device requiring high mechanical strength. In this work, copper-graphite-CNF composites were prepared by adding graphite and CNF reinforcement to copper matrix to improve the thermal conductivity and mechanical strength of copper and to decrease the density. The thermal conductivity and the mechanical properties of the copper-graphite-CNF composites were investigated according to the amount of graphite and CNF added.

R090-A

Time: 14:25-14:40

Fabrication of Emulsion Electrospun Core-Sheath Composite Nanofibers Containing Natural Cinnamon Essential Oil

Ms. Yoonwon Jung, Mr. Hyukjoo Yang, Assoc. Prof. Seungsin Lee
Yonsei University, Korea

With the growing trend toward enhancing human well-being and protecting against environmental pollution, research on environmentally friendly textile products using natural extracts is currently prominent. Cinnamon essential oil is primarily composed of cinnamaldehyde, which possesses anti dust mite, antibacterial, and anti-inflammatory properties. The objectives of this study were to explore the process of fabricating core-sheath composite nanofibers by using cinnamon oil and PVA emulsion electrospinning and to investigate the suitable processing conditions for the uniform diameter and stable morphology of nanofibers. The suitable concentration for fabricating core-sheath structured nanofibers was 4.29 wt% of cinnamon oil, 12 wt% of PVA, and 0.86 wt% of a surfactant. The spinning parameter conditions for fabricating core-sheath structured nanofibers were as follows: a solution feed rate of 0.2 mL/hr, a needle gauge of 23, a voltage of 25 kV, and a tip-to-collector distance of 20 cm. The results showed that uniform, stable core-sheath structured nanofibers containing cinnamon oil can be successfully fabricated using emulsion electrospinning. Additional research is underway to examine the controlled release of the cinnamon oil from the composite nanofibers by gas chromatography-mass spectrometry analysis.

R092-A

Time: 14:40-14:55

Investigating Mechanical Properties of Polypropylene Composites with Inorganic Filler

Prof. Jia-Lin Tsai, Ching-Hsiang Chang, Yueh-Shin Liu and Yao-Chu Chung
National Chiao Tung University, Taiwan

The study aims to investigate the mechanical properties of polypropylene (ethylene-methacrylic acid copolymers modified) composites containing there different loadings of inorganic filler, i.e., 10wt%, 20wt% and 30wt%. Two kinds of inorganic fillers were considered, one is magnesium oxysulfate whisker and the other is acicular wollastonite crystal. The extent of dispersion of the inorganic filler was examined through the scanning electron microscope (SEM). Tensile testes demonstrated that when the loading of the inorganic filler increases, the moduli of the polypropylene composites increase accordingly. The incremental tendency of the moduli in terms of inorganic filler loading was appropriately characterized using Mori-Tanaka micromechanical model. It was indicated that for both composite material systems, the fracture toughness achieves the peak value when the inorganic filler loading is 10wt% and then declines with the increment of the inorganic filler. Based on the SEM observation on the fracture surfaces, the decrement of the fracture toughness could be attributed to the severe aggregation of the inorganic fillers in the composites.

R118

Time: 14:55-15:10

Effects of GnF Concentration on the Mechanoelectrical Properties and Surface Morphology of GnF/PDMS Composites

Mr. Young Choi, Sanghyun Park, Sungmin Park, Gyungmok Nam, Seungpyo Woo,

Sangheon Park, Wonyoung Uhm, and Sang-Hee Yoon
Inha University, Republic of Korea

The graphite nanoflake (GnF)-reinforced polydimethylsiloxane (PDMS) composites (GnF/PDMS composites) are developed as new polymer matrix composites (PMCs) with controllable mechanoelectrical properties. Here, we investigate the effect of GnF concentration on the mechanoelectrical properties (i.e., elastic modulus, fracture strain, and conductivity) of GnF/PDMS composites; the change in the surface morphology of GnF/PDMS composites caused by a variation in GnF concentration is also explored. The mechanoelectrical properties are measured by performing tensile tests on the GnF/PDMS composite specimens with different GnF concentrations of 5.0, 10.0, 12.5, 15.0, 20.0, and 25.0 wt.%. The surface morphology is analyzed in terms of internal void formation and surface roughness. The elastic modulus is measured to be in the range of 1.62 to 13.8 MPa which is proportional to GnF concentration, while the fracture strain and electrical conductivity are respectively characterized to be in ranges of 0.09 to 2.09 and 0.3 to 221.0 S/m which are in inverse proportion to GnF concentration. An increase in GnF concentration leads to increases in internal voids' amount and surface roughness. The GnF/PDMS composites can be used as sensing materials for detecting both small and large deformations in a variety of engineering applications.

R119

Time: 15:10-15:25

UV Photopatternability and Electrical Properties of GnF/SU-8 Composites Controlled by GnF Concentration

Mr. Seungpyo Woo, Sungmin Park, Gyungmok Nam, Young Choi, Sangheon Park and Sang-Hee Yoon
Inha university, Republic of Korea

The GnF/SU-8 composites are new polymer matrix composites (PMCs) composed of graphite nanoflakes (GnFs) bound together by SU-8 photoresist. The PMCs therefore have excellent ultraviolet (UV) photopatternability and high electrical properties. In spite of the unique material properties of GnF/SU-8 composites, much still remains uncertain about their controllability in both UV photopatternability and electrical properties. Here, we investigate 7 kinds of GnF/SU-8 composites having different GnF concentrations of 5.0 to 25.0 wt.% to characterize the changes in the UV photopatternability (i.e., polymerized thickness and photopattern quality) and electrical conductivity of GnF/SU-8 composites caused by a variation in GnF concentration. The polymerized thickness of GnF/SU-8 composites is measured to be in the range of 4.06 to 23.99 μm, which is inversely proportional to GnF concentration and also directly proportional to UV dose (i.e., 345 to 3,450 mJ/cm^2) because of the screening effect of GnF existed in the composites; the photopattern quality at the edge is in inverse proportion to GnF concentration. An increase in GnF concentration leads to a significant change in the electrical conductivity of GnF/SU-8 composites in a proportional way (up to 25.34 S/m). The GnF/SU-8 composites are expected to be widely used as UV photopatternable and electrically conductive PMCs for diverse engineering applications.

R2014-A

Time: 15:25-15:40

Toughing Epoxy with <1 wt% Polyhedral OligomericSilsesquioxane-modified Nanoclay

Dr. Shengqin Wang, Jian Wei Xu
Institute of Materials Research and Engineering, Singapore

Toughening of epoxy resins has represented a central topic in composite studies since the

early 1980s. Despite the numerous advantages that it offers such as excellent mechanical properties and thermal stability, epoxy is intrinsically brittle due to its high crosslink density. The deficiency in toughness properties is one of the key drawbacks that limit the application ranges of epoxy across various industries. Different strategies have been developed to improve the toughness of epoxy. The most traditional way is to incorporate rubber particles at volume loading ratio of 5 - 20%. Despite the high effectiveness in toughening, the addition of rubbers leads to decrease the stiffness and thermal properties of epoxy. High performance thermoplastic engineering polymers have also been used as toughening modifiers. However, it is generally difficult to blend such thermoplastics with epoxy. Furthermore, it also decreases the thermal and mechanical properties despite the lower reduction magnitude than that using rubber.

In recent years, toughening epoxy using nanomaterials such as nanoclay, graphene and nanosilica has attracted extensive research interests due to the high rigidity of the filler and the effectiveness at very low volume loadings. The use of nanoclay in toughing epoxy is particularly interesting because of its high aspect ratio, high strength and abundance in nature. For nanoclay/epoxy composites, the exfoliation of nanoclay layers and the resultant dispersion in epoxy matrices are the key factors governing the performance. There are basically two methods in previous studies for the clay modification. The first method is to use organic surfactants, which however results in low level of exfoliation and poor dispersion in epoxy. Consequently, the strength and glass transition temperature of epoxy composites were significantly decreased. The other one uses silane functionalized with epoxide or amine groups to modify clay, obtaining highly exfoliated clay in epoxy. With this method, the glass transition temperature of epoxy is retained while the fracture toughness is increased. However, at the same time the tensile strength of epoxy is undesirably decreased. Furthermore, it is shown that 2.5-5 wt% loading of nanoclay is required to effectively enhance the mechanical performance of epoxy.

In the present paper, we have developed a method to modify nanoclay with achieved very high exfoliation state in epoxy. Polyhedral oligomeric silsesquioxane (POSS) functionalized with epoxide groups was utilized to tune the surface chemistry of nanoclay. Due to the outstanding thermal property of POSS, the resultant nanoclay/epoxy composite exhibits a high Tg that is identical to the neat epoxy, which is contrast to that a decreased Tg is obtained with the use of surfactant modified nanoclay. Owing to the large d-spacing and the existence of epoxide groups on its surface, the modified clay was highly exfoliated and homogeneously dispersed in epoxy. As a result, the mechanical properties of epoxy can be enhanced at very low loadings of POSS-modified clay. The fracture toughness was increased by 52% at only 0.8 wt% of clay loading. Furthermore, the tensile strength was slightly increased with the incorporation of POSS-modified clay, which is contrary to the reduction by the addition of silane-modified clay.

EM2010

Time: 15:40-15:55

Salt-responsive AM/AMPS/ATC terpolymers as Modifiers for Rheology and Fluid loss in Water-based Drilling Fluid

Dr. Yinbo He, Guancheng Jiang, Wuge Cui
China University of Petroleum, China

In this study, we report salt-responsive amphoteric terpolymers prepared by copolymerization of acrylamide (AM), 2-acrylamido-2-methylpropanesulfonate (AMPS) and 3-acrylamidopropyl trimethylammonium chloride (ATC), and their use as rheology and fluid loss modifiers in water-based drilling fluid (WDF). The dependence of viscosity and turbidity on NaCl concentration indicates the salt-responsiveness of terpolymers, which results from salt-induced polymer conformation changes. In the presence of large quantities of NaCl, comparing with BT/polyanioins solution, bentonite (BT)/terpolymer solution has better shear thinning and thixotropic performance as well as lower fluid loss. Morphology shows that

BT/terpolymer solution with NaCl creates high-quality filtrate cake which is compact and thin. A salt-resistant WDF prepared with terpolymers is evaluated and compared with polyanioinc WDF and polyanionic sulfonated WDF. The salt-resistant WDF possesses more favorable rheology, lower fluid loss and stronger tolerance for temperature, suggesting the potential use of AM/AMPS/ATC terpolymers as high-performance additives for salt-resistant WDFs.

Coffee Break

15:55-16:10

16:10–18:25, Sunday, 21 Jan.

Session B–3: Building Materials

Venue: ***2nd Meeting Room***
Chair:

R025

Time: 16:10-16:25

Evaluation of the Influence of the Waste Originated by the Production of Titanium Dioxide (URM) on the Physical-Mechanical Properties of coating Mortars

Assoc. Prof. Daniel Véras Ribeiro, Diana Dayse Mariano de Albuquerque, José da Silva Andrade Neto, Nilson Santana de Amorim Júnior, Vitor Souza Santos
Federal University of Bahia, Brazil

Waste generation is one of the main problems of contemporary society, resulting in high economic costs and environmental impacts, such as the contamination of water sources, groundwater and soil. In this context, there is the unreacted mineral (URM), a waste originated by the production of titanium dioxide, which currently does not have an effective reuse plan, being deposited in a controlled landfill, generating a high economic expense for the generating company. In this way, the present work aims to evaluate the influence of URM on the properties of coating mortars. Firstly, it was carried out a physical, chemical and mineralogical characterization of the waste and, afterwards, coating mortar was prepared with additions of 0% (reference), 5%, 10% and 15% of the waste, in relation to the cement mass. The mortars were evaluated for density, porosity, capillary absorption by capillarity and mechanical strength. It was noted that the waste increased the mechanical strength of the mortars studied and did not significantly influence the other evaluated properties. Therefore, the incorporation of the waste into mortars is an interesting and feasible alternative for the destination of the URM.

R054

Time: 16:25-16:40

Effects of Octyl Phenyl Sulfoxide on the Hydration of Cement

Chia-Hsin Liu, Jo-Chuan Kan and **Prof. Maw-Tien Lee**
National Chia-Yi University, Taiwan

Controlling the hydration rate of cement can influence the properties of cement hydrates. Many commercial cement retarders are mainly adopted for slowing down the rate of cement hydration. In this study, the surface of the cement particles were modified by an organic sulfoxide to retard the rate of cement hydration. The organic sulfoxide, octyl phenyl sulfoxide, was firstly synthesized by reacting 1-dodecanethiol with aryl iodide to octyl phenyl sulfide, and then oxidized to the corresponding sulfoxide. The organic sulfoxide was identified by Nuclear Magnetic Resonance Spectroscopy (NMR). Hydrates of cement and cement modified with octyl phenyl sulfoxide were characterized by Fourier Transform Infrared Spectrometer (FTIR), Optical Microscope (OM), Scanning Electron Microscope (SEM) and powder X-Ray Diffraction (pXRD). Experimental results showed that octyl phenyl sulfoxide successfully decreased the rate of cement hydration and had positive effect on the long term microstructures of the harden cement paste.

R026

Time: 16:40-16:55

Influence of Physicochemical Properties of Sugarcane Bagasse Ash (SCBA) in Portland Cement Hydration

Assoc. Prof. Daniel Véras Ribeiro, Tiago Assunção Santos, José da Silva Andrade Neto, Vitor Souza Santos
Federal University of Bahia, Brazil

Due to the concern with the environmental impacts caused by the gases emitted by the cement industry and by the inadequate disposal of wastes generated in the sugar-alcohol industry, such as sugarcane bagasse ash (SCBA), a search for the development of new technologies, which are less aggressive to the environment and that propose feasible alternatives, began in order to reuse these wastes properly. Among these alternatives is the reuse of SCBA as partial replacement to cement or as addition to cementitious matrices. In this way, the present research has the objective of analyzing the influence of SCBA obtained by the calcination of sugarcane bagasse (SCB), at 600 ℃, in the process of Portland cement hydration. Initially, the SCBA was characterized physically, chemically and mineralogically, and then cement pastes with 20% and 35% substitution contents were elaborated, besides the reference paste, which were analyzed through X-ray diffraction (XRD) and thermogravimetric (TG) techniques. The results obtained show that there is a consumption of portlandite as a consequence of the use of SCBA, evidencing the pozolanicity of these ashes. In the pastes with 35% substitution content, there was an intense consumption of the portlandite, indicating, in this proportion, the pozzolanic reaction was more intense.

R069-A

Time: 16:55-17:10

Tensile Strength of Green Self-Consolidating Concrete

Prof. Osama Ahmed Mohamed, Omar F. Najm and Waddah Al-Hawat
Abu Dhabi University, United Arab Emirate

The environmental footprint of the construction industry in general must be reduced. The process of manufacturing cement involves the release of appreciable amounts of CO_2 into the atmosphere. This paper summarizes the findings of an experimental study aiming at assessing the splitting tensile strength of self-consolidating concrete (SCC) in which 90% of the cement was replaced with various amounts of the industrial by-products including silica fume, fly ash, and ground granulated blast furnace slag (GGBS). Due to the high replacement ratio of cement with recycled industrial by-products, the produced SCC is referred in this study as *green concrete*. The compressive strength ranged between 30 MPa and 50 MPa and was produced with water/cementitious material ratios of 0.33 and 0.36. The splitting tensile strength was determined and a correlation was developed using regression analysis between the splitting tensile strength and compressive strength.

R104

Time: 17:10-17:25

Investigation of Gamma Radiation Shielding of Concrete Containing Blast Furnace Slag Waste via Experimental and Calculation Methods

Pranpriya Phutthanet, Pithiwat Tiantong, **Asst. Prof. Phongthorn Julphunthong**, Panuwat Joyklad, Lijie Wang and Prinya Chindaprasirt
Naresuan University, Thailand

This study aims to evaluate gamma-ray shielding characteristics of concrete produced from blast furnace slag. The chemical and physical properties of the aggregates including the chemical composition and specific gravity were investigated to evaluate their radiation shielding properties. The samples were prepared with a cement content of 400 kg/m^3, a water to cement ratio of 0.4, and fine aggregate of 43% and coarse aggregate ratio of 57%. Blast furnace slag was replaced with sand at 25%, 50%, 75% and 100% by volume to improve the shielding properties. The compressive strengths at 3, 7 and 28 days and the unit weight of the prepared samples were determined. The linear attenuation coefficient was measured and calculated at photon energies of 0.662 MeV, 1.17 MeV and 1.33 MeV. The WinXCom program was employed to calculate the attenuation coefficient from the chemical composition of samples and the results were compared to the measured results. The study results suggest that the use of blast furnace slag is effectively in improving the compressive strength and shielding properties of concrete. The increase of blast furnace slag caused an increase in the linear attenuation from 0.190 cm^{-1} to 0.210 cm^{-1} at 0.662 MeV.

R070

Time: 17:25-17:40

Durability of Sustainable Self-Consolidating Concrete

Prof. Osama Ahmed Mohamed, Waddah Al-Hawat and Omar F. Najm
Abu Dhabi University, United Arab Emirate

Supplementary cementitious materials such as fly ash, silica fume and ground granulated blast furnace slag (GGBS) have been used widely to partially replace cement in producing self-consolidating concrete (SCC). The production of cement is associated with emission of significant amounts of CO_2 and increases the human footprint on the environment. Fly ash, silica fume, and GGBS are recycled industrial by-products that also impart favorable fresh and hardened properties on concrete. This study aims to assess the effect of the amounts of fly ash and silica fume on strength and chloride penetration resistance of concrete. Rapid Chloride Penetration Test (RCPT) was used to assess the ability of SCC to resist ingress of chlorides into concrete. SCC mixes with different dosages of fly ash and silica fume were developed and tested at different curing ages. Test results showed that replacing 20% of cement with fly ash produced the highest compressive strength of 67.96 MPa among all fly ash-cement binary mixes. Results also showed that replacing15% of cement with silica fume produced the highest compressive strength of 95.3 MPa among fly ash-cement binary mixes. Using fly ash and silica fume consistently increased the concrete resistance to chloride penetration at the early ages. Silica fume at all dosages results in low or very low levels of chloride penetration at all curing ages of concrete.

B010-A

Time: 17:40-17:55

Strength and Pore Strcuture of Cement Paste After Post-Fire Curing

Mr. Tatsuya Kitada, Zhuguo Li
Yamaguchi University, Japan

When subjected to a high-temperature heating of fire, concrete will deteriorates due to dehydration and cracking. However, its mechanical performances and durability would recover to a certain extent by re-curing due to re-hydration. In this study, for clarifying the influencing factors of performance recovery of
heated concrete, we examined the compressive strengths and pore structures of cement pastes subjected to different high temperatures, cooled and further re-cured in the air or

water. As a result, the compressive strength of the cement paste almost recovered to the level before heating if the heating temperature wasn't above 450°C and was cooled by water, or cooled in the air but re-cured in the water. Moreover, heating resulted in coarse pores in the cement paste, but re-curing made the coarse pores fine again, especially in case of water re-curing, and the water-cooling decreased the coarse pores.

R005

Time: 17:55-18:10

Strength and Microstructural Properties of Mortar containing Soluble Silica from Sugarcane Bagasse Ash

Assoc. Prof. Andri Kusbiantoro, Rahimah Embong, Azrina Ab Aziz
Universiti Malaysia Pahang, Malaysia

Sugarcane bagasse is among the abundantly available waste in agriculture industry. The proportion of siliceous ashes after the incineration process is one of the attractive features in sugarcane bagasse. However, its low bulk density would result in an additional issue for further use as cement replacement material, since higher replacement volume will bring more hydrophilic particles of sugarcane bagasse ash into the mixture. Therefore this research aims to extract the reactive silica from sugarcane bagasse ash and increase its bulk density by converting it into soluble form. The process was divided into three stages, which were pre-treatment and incineration of sugarcane bagasse, conversion into soluble form, and production of mortar specimen. Soluble silica from sugarcane bagasse ash was used to partially replace cement content in mortar, hence its effect on the hydration process can be evaluated. Compression test and scanning electron microscope analysis were performed to observe its effect on the strength and microstructural development of mortar framework. The results show that the inclusion of soluble silica would enhance the early hydration rate and improve the consolidation of cement matrix via additional calcium silicate hydrate formation, which would increase the capability of internal mortar framework to distribute loads and achieve higher strength.

R2013

Time: 18:10-18:25

Effect of Construction Material on Greenhouse Gases Emission and Energy Use for Residential Buildings

Lih-Yau Song, Meng-Ting Tsai, **Ms. Rina Yadav**
National Taipei University of Technology, Taipei, Taiwan

This research work shows how building construction material effects environment, it is based on the performance of ecofriendly (mud) and non-ecofriendly (concrete) materials on the similar residential buildings, located in the climate of Delhi, India. Comparative study of Mud and concrete has been performed. The analysis of each case study includes the calculation of annual carbon emission and energy use, was simulated by using Autodesk Revit software (version2015). As per result, it is clearly visible that by using ecofriendly material we are able to save 93% annual energy cost.

Dinner@ *ITRI ITO Restaurant*

18:50-20:00

Date: 21 Jan. 2018(Sunday)

Time: 12:40-13:55

Venue: 3rd Meeting Room

Time	
12:40-13:55	**Session C-1: *Heat Treatment and Casting Engineering***
13:55-15:55	**Session C-2: *Nanomaterials and Optoelectronic Materials***
15:55-16:10	*Coffee Break& Session P-2*
16:10-18:40	**Session C-3: *Civil and Constructional Engineering***

Note:

* Please control each presentation time within 15 mins, including Q & A.
* The certification of Oral presentations, will be awarded at the end of each session.
* Best Presentation of each session is encouraged to award to student author prior.
* Winner of Best presentation will be announced at the end of each session and awarded winner certificate over the banquet on Jan. 21.
* To show respect to other authors, especially to encourage the student authors, we strongly suggest you attend the whole session.
* The scheduled time for presentations might be changed due to unexpected situations, please arrive meeting room at least 10 Mins before your Session starts.
* Session photo will be taken at the end of each session and updated online.

12:40–13:55, Sunday, 21 Jan.

Session C–1: Heat Treatment and Casting Engineering

Venue: *3rd Meeting Room*
Chair:

R115-A

Time: 12:40-12:55

High Cycle Fatigue Behavior of Dissimilar High-Mn Steel Welds at Cryogenic Temperature

Woojin Ahn, Junhyuk Park, Kwanho Lee, Daeho Jeong, **Assoc. Prof. Hyokyung Sung** and Sangshik Kim
Gyeongsang National University, South Korea

In this talk, high cycle fatigue behavior of dissimilar metal weld between high-Mn (HM) steel and 304L stainless steel was investigated at 298 and 110 K. The S-N fatigue behavior of dissimilar metal joints between HM steel and 304L could be predicted by tensile strength level at both room and cryogenic temperatures, as in the case of base metal. It is suggested that the geometrical factor played an important role in S-N fatigue behavior of HM/304L weld joints to identify the failure location and analyzing the micro-hardness. For successful cryogenic structural applications of HM steels, they need to demonstrate proper weldability to dissimilar metals. In the HM steels, proper weldability is required to apply for the cryogenic structural materials. In this study, the S-N fatigue behavior of dissimilar metal weld between HM steel and 304L STS was investigated at 298 and 110 K. The fatigue mechanisms of HM steel/304L STS welds were analyzed based on the microstructural and fractographic analyses. The geometrical morphologies of welds and the location of fracture were analyzed to understand the S-N fatigue behavior of weld joint between HM steel and 304L STS.

R019-A

Time: 12:55-13:10

Development of Renewable Materials Applied to EAF and LF Procedures

Mr. Chia-Chun Li, Chi-Ming Lin, Yu-En Chang and Weite Wu
National Chung Hsing University, Taiwan

The purpose of research can transform industrial waste into valuable supplements, the small pieces scrap of metal processing can replace part of large scrap in EAF procedure; Ladle furnace slag can replace lime as dephosphorizer in steel smelting process; the semiconductor industries use hydrofluoric acid that generated calcium fluoride sludge. After treatment the calcium fluoride sludge can convert to artificial fluorite, and replace expensive natural fluorite as flux applied to refining procedure. These wastes can be applied to steel-making procedure, and effectively reduce the problem of environmental pollution. In this study, the small pieces scrap of metal recovery can achieve82%by induction furnace. When refining slag+ supplement as dephosphorizer applied to dephosphorization process, the ratio of dephosphorization is 82%and the ratio of resulfurization is 16%in 20 minutes. Artificial fluorite as flux applied to refining desulfurization procedure, the results show 15% artificial fluorite+ 85% lime as desulfurizer that ratio of desulfurization is 91% in 10 minutes. Based on the aforementioned results, the concept of this study proved to be feasible. This method can

keep the cost down of steel-making and disposal of waste, and enhance competitiveness.

R046

Time: 13:10-13:25

Effect of Resin Coated Sand Mixture on Bending Strength and Cost

Mr. Puvadol Sirivimonpan
Chulalongkorn University, Thailand

This research proposed a method to find out the relationship between bending strength of resin coated sand and the proportion of different types of sand and resin. It was figured out that Central Composite Design (CCD) was suitable to be used to save the number of experimental runs. Then, backward elimination regression analysis was used to determine the relationship equation of bending strength and proportion of different types of sand and resin. Next, optimization technique was applied to determine the optimal new setting, which provided any targeted level of bending strength with the minimal total cost of sand and resin. The results showed that the experimental results obtained from the CCD experiments provided the regression model, which had less than 6% error from the actual bending strength value. With this proposed method the total cost of sand and resin was reduced by 28.6% on average and it also provided the bending strength on any required target level.

R047

Time: 13:25-13:40

Improvement of Bending Strength of Resin Coated Sand

Mr. Jakkapan Jariyajirawatana
Chulalongkorn University, Thailand

This research proposed a method to improve bending strength of RCS used in hollow core production by finding the optimal levels of factors in the mixing process. Process factors under study were temperature of sand, time to release phenolic resin, time to release hexamine solution, time to start air blowing, air blowing time duration, and time to release calcium stearate. Experiments with Central Composite Face-centered (CCF) design were performed to save the number of experimental runs. Then, backward elimination regression analysis was performed to find out the relationship equation of bending strength and significant process factors. Next, the optimization technique was applied to determine the optimal setting of those significant process factors. The comfirmatory result showed that bending strength was significantly improved.

R1024

Time: 13:40-13:55

Conversion of Electric Arc Furnace Dust into Ceramics Using Thermodynamic Calculations and Experimental Work

Ahmad Mostafa, **Dr. Mohamed Shahtout**, Tariq Al Afeefi and Mamoun Medraj
Emirates steel – United Arab Emirates

Steelmaking is accompanied with releasing a large quantity of solid particle in the form of dust. Electric arc furnace dust (EAFD) is known to have high pH number and traces of heavy metals. The objective of this work was to find a suitable procedure for converting the dust waste into inert and useful byproducts using thermodynamic calculations and experimental investigation. The physical, chemical and mineralogical characteristics of initial EAFD were analyzed using different techniques, such as: X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), grain

size analysis and metallography. The pH measurement procedure was carried out in accordance with the standard test method for pH of soils “ASTM 4972-95a”. The results of XRD, SEM and EDS analysis were consistent and showed that Fe_2O_3, CaO, Al_2O_3, SiO_2, MgO, ZnO and traces of other oxides are in the main composition of the EAFD batches with different relative amounts. Furthermore, the particle size measurements revealed that the EAFD particles are in the 0.1 to 394 μm size range. The pH number was ranging between 11.15 and 12.21 for all measurements. The experimental results were used as input data for thermodynamic calculations and accordingly SiO_2 and Al_2O_3 were among the candidates for making ceramic materials through forming glass regions that surround and encapsulate the iron oxide particles. SiO_2 modified samples exhibited better apparent structural properties than other compositions. Whereas Al_2O_3-modified samples showed variation in the product color. Thus, it is concluded from this work that a mixture of EAFD can be modified by 5-20 wt.% of SiO_2 and then fired at 1100 ℃ to make inert ceramic materials with reasonable mechanical properties.

13:50–15:55, Sunday, 21 Jan.

Session C–2: Nanomaterials and Optoelectronic Materials

Venue: *3rd Meeting Room*
Chair:

R048-A

Time: 13:55-14:10

Growth of a Superhydrophobic Multi-walled Carbon Nanotube Forest on Quartz Using Flow-vapor-Deposited Copper Catalysts

Chung-Hsuan Hsiao and **Prof. Jarrn-Horng Lin**
National University of Tainan, Taiwan

Although studies on carbon nanotube (CNT) growth have made great advancements, direct growth of highly dense CNTs on desired substrates or positions remains an important challenge. Herein, we report a simple method to directly fabricate a CNT forest on a quartz surface using a copper catalyst at 850oC under a stream of argon-diluted ethanol. Copper nanoparticles (NPs) are used as catalysts, which are generated through flow-vapor-deposition of copper (II) acetylacetonate on a thermal-treated SiO2 (quartz) or Si (silicon wafer) surface. Dense tangled CNT forms on the quartz surface. However, when a silicon wafer is used as the substrate, the only product is a carbon-covered copper NPs instead of CNTs. The growth yield of CNTs is approximately 10.5 g CNT/g Cu has characterized by thermogravimetric analysis, which is remarkably high compared with those achieved by conventional copper-based catalysts. The stronger metal-support interaction of copper NPs with quartz is suggested to be the key factor for CNT growth. Bamboo-like MWCNTs (BMWCNTs) are the main structures formed through transportation of copper NPs during CNT formation as evidenced by HR-TEM micrographs. Moreover, CNT-grown quartz has superhydrophobic features with a contact angle of 154o, revealing its promising application in self-cleaning coatings.

R3011

Time: 14:10-14:25

Controlling the Absorption of Gold Nanoparticles via Green Synthesis Using Sargassum Crassifolium Extract

Ms. Angeline F. Maceda, Johnny Jim S. Ouano, Mar Christian O. Que, Blessie A. Basilia, Melchor J. Potestas, Arnold C. Alguno
Mindanao State University – Iligan Institute of Technology, Philippines

This work controls the absorption of gold nanoparticles (GNPs) via green synthesis utilizing *Sargassum crassifolium* extract. The amount of seaweed extract acts as both reducing (from Au^{+} to Au^{0}) and capping agent. The *S. crassifolium* extract is mainly composed of biomolecules such as protein and phenolic compounds which are responsible for the synthesis of GNPs. The synthesized GNPs were characterized using UV-Visible spectroscopy, Fourier Transform Infrared (FTIR) spectroscopy and Transmission Electron Microscopy (TEM). UV-Vis spectra revealed peaks around 505 nm to 544 nm which corresponds to the Surface Plasmon Resonance (SPR) of GNPs. FTIR spectroscopy analysis showed peak at 825 cm^{-1} and 1144 cm^{-1} which corresponds to the signature peaks of GNPs. Polydisperse GNPs with varied sizes (between 5 nm to 300 nm) were further confirmed by TEM analysis.

R3021-A

Time: 14:25-14:40

Multifunctional Novel Ruthenium Dye (RuC) for Nanocrystalline Titanium dioxide / Poly (3-heylthiophene) hybrid Solar Cells

Pirashanthan., Thanihaichelvan. M , Shivatharsiny. R, Dhayalan V, **Prof. Ravirajan. P**
South Eastern University of Sri Lanka, Sri Lanka

Hybrid solar cells with conjugated polymers as donors and metal oxide nanocrystals as acceptors have generated significant interest owing to their light weight, low cost, mechanical flexibility, and simple solution processing methods. However, it's well documented that the poor charge separation and collection efficiencies and limited spectral response of polymer limits their power conversion efficiencies due to the disordered metal oxide-polymer interface. Hence the power conversion efficiencies are heavily depends on the quality of the interface. Engineering the interface is a well-known technique to improve the charge separation, collection and transport in hybrid solar cells. Range of novel organic and inorganic materials were successfully tested as the interface modifiers which results with improved power conversion efficiencies of the hybrid solar cells.
In this work, we report the multifunctionality of a novel Ru based dye (RuC) in enhancing the performance of nanocrystalline Titanium dioxide / Poly (3-heylthiophene) (TiO_2/ P3HT) hybrid solar cells. TiO_2/P3HT nanocomposite films were fabricated with and without the RuC dye as the interface modifier and their optical properties were tested using UV-Vis and photoluminescence (PL) spectroscopies. UV-Vis spectra of the TiO_2 / RuC and TiO_2/RuC/P3HT films ensure that the absorption spectra is broadened in the UV region due to the addition of dye. The PL measurements were carried out using a 530 nm pumping laser to selectively excite the P3HT. The PL of TiO_2/ P3HT nanocomposite films were strongly reduced when the RuC dye was introduced at the TiO_2/RuC interface. The PL quenching ensure the efficient exiton dissociation in P3HT during illumination. The solar cells were then fabricated using successive evaporation of MoO_3 and silver on top of the films and tested in a simulated irradiation of 100 $mWcm^{-2}$ at AM 1.5 conditions. The insertion of dye improves the power conversion efficiency by a factor of two, which is mainly due to the enhanced short circuit current density attributed to the broaden spectral response as confirmed by broadened external quantum efficiency (EQE) spectra.

R122-A

Time: 14:40-14:55

Highly Resolved 3D Features in an Ultrathin Cellulose Paper

Prof. Jinho Hyun
Seoul National University, Korea

The structure printed freely in bulky cellulose nanofiber (CNF) hydrogels was able to retain its highly resolved 3D features in an ultrathin 2D paper using a simple drying process. The dimensional change in CNF hydrogels from 3D to 2D resulted from simple dehydration of CNFs and provided transparent, stackable paper-based 3D channel devices. As a proof of principle, the rheological properties of CNF hydrogels, 3D structure of ink, formation of channels by evacuation of ink, and highly localized selectivity of the devices are described.

R1021-A

Time: 14:55-15:10

Synthesis, Optical and Electronical Properties of Hollow Gold/SiO2/CdSxSe1-x Core/Shell/Shell Nanostructures

Ms. Dai-Yun Kuo and Ying-Chih Pu
National University of Tainan, Taiwan

Metal/semiconductor core/shell nanostructures have attracted intensely scientific interest in the past decade due to their remarkable charge separation properties, leading to the widely utilization in photoelectric conversion applications. Among the different kinds of metal core nanospheres, Au core was caused lots of attention because of the tunable surface plasmon resonance(SPR)properties across the visible and near-infrared (NIR) regions. However, the multiple SPR absorption of Au nanostructures would depend on the different morphology as well as the different synthesis approaches, which was difficult to well match the absorption of semiconductor shell to achieve the plasmonicenhancementin photoelectric conversion. In this study, we developed an easy method to synthesize the hollow gold nanospheres (HGN) with the tunable SPR absorption from 500-700 nm through the controlof their particle size. By using the obtained HGN as the templates to coat SiO2 and CdSxSe1-xto form HGN/SiO2/CdSxSe1-x core/shell/shell nanostructure by hydrothermal methods. The absorption region of CdSxSe1-x can be well controlled by tuning the ratio of S/Se in the hydrothermal process, which also overlapped well with the SPR absorption peaks of the HGN cores. The photoeletric conversion properties were systematically studied usingtime-resolved photoluminescenceto understand the plasmoniceffect of HGN core toward the charge carrier recombinationprocess of CdSxSe1-xshell.The present HGN/SiO2/CdSxSe1-x core/shell/shell nanostructure can serve as an insightful model to study their photoelectric conversion properties for the application in different fields.

R1023

Time: 15:10-15:25

Molecular Vibration Theoretical Analysis of Two-dimensional Photoelectric Conversion Material WSe2

Ms. ZHANG Rui, LI Hongbo, HAO Guoqiang, YE Xiaojun, LI Zhenghong, YUAN Xiao, LIU Cui
East China University of Science and Technology, China

Monolayer WSe_2 is flexible, nearly transparent and direct band-gap semiconductor with the potential to be new generation thin film photoelectric conversion materials. The molecule vibration modes of monolayer and bulk WSe_2 was analyzed by factor group and the phonons dispersion and vibration frequency was calculated by first-principles based on density functional theory. Furthermore, the comparison between the above calculations and experiment values of Raman shift of monolayer and bulk WSe_2 was made to verify the accuracy of theoretical analysis and theoretically explain the differences of monolayer and bulk WSe_2 materials in Raman spectra.

R1016-A

Time: 15:25-15:40

Optical Properties, Surface Ligand Effect and Charge Carrier Dynamics of Organolead Halide Perovskite Nanocrystals

Mr. Ying-Chih Pu

National University of Tainan, Taiwan

In recent years, the organolead halide perovskite (CH3NH3PbX3, X = Cl, Br, and I) nanocrystals (NCs) caused lots of attention because of their unique optical properties. CH3NH3PbX3 NCs not only showed the great quantum yield (QY) of photoluminescence (PL) but also exhibited the emission wavelength tunable properties, resulting in a potential candidate for the practical using in light emitting diodes (LEDs). In this study, we demonstrated a facile synthesis to obtain the CH3NH3PbBr3 NCs with high purity green PL emission at 515 nm under room temperature and air atmosphere. In addition, the PL emission can be further modulated from green region to blue (425 nm) or red (700 nm) by replacing the composition of Br with Cl or I of the perovskite NCs, respectively. The detail charge carrier dynamics of the obtained organolead halide perovskite NCs was investigated by transient absorption (TA) and time-resolved photoluminescence (TRPL) spectroscopy, which provide us the meaningful insights for the detail charge carrier recombination processes. On the other hand, the surface ligand of the perovskite NCs not only played an essential role to modulate the charge carrier dynamics, but also improve the stability. The current study developed an easy method to synthesize organolead halide perovskite NCs with tunable optical properties and highly chemical stability. In addition, the results demonstrated the great potential of organolead halide perovskite NCs for the future applications in photoelectric devices and elsewhere

R1017-A

Time: 15:40-15:55

Optical and Charge Transfer Properties of Cesium Lead Halide Perovskite/Reduced Graphene Oxide nanocomposites

Mr. Jin-Kun Ye and Ying-Chih Pu
National University of Tainan, Taiwan

Cesium lead halide (CsPbX3, X=Cl, Br and I) perovskite nanostructure represented a great potential for the utilization in photoelectrical applications. Due to the low cost manufacturing, unique optical properties, and highly PL QY. In addition, CsPbX3 combined with graphene oxide (GO) to form nanocomposites has been demonstrated the photoactivity to reduce carbon dioxide. However, the detail interfacial charge transfer behavior between CsPbX3 and GO is still lacked. In this study, we used the ligand-assisted reprecipitation (LARP) method to prepare CsPbX3/reduced graphene oxide (rGO) nanocomposites. By controlling the precursors during LARP process, we can well control the composition and ratio of CsPbX3/rGO. The investigation of their interfacial charge carrier dynamics was carried out using time-resolved photoluminescence spectroscopy. The comparison of PL lifetime between CsPbX3 and CsPbX3/rGO indicated that the CsPbCl3/rGO showed the highest interfacial electron transfer rate constant (ket) than CsPbBr3/rGO or CsPbI3/rGO. The reason to observed the faster interfacial electron transfer behavior in CsPbCl3/rGO can be suggested as that the larger potential difference between the conduction band of CsPbCl3 and Fermi level of rGO, resulting in the larger driving force to boost the electron injection form CsPbCl3 to rGO. Systematic realization of the interfacial charge transfer behavior of CsPbX3/rGO nanocomposites provides the useful insights to design the provskite composites for the utilization in further photoelectrical conversions.

Coffee Break

15:55-16:10

16:10–18:40, Sunday, 21 Jan.

Session C–3: Civil and Constructional Engineering

Venue: ***3rd Meeting Room***

Chair:

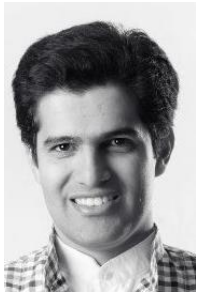
B001

Time: 16:10-16:25

Seismic Fragility Assessment of Building with Metallic Hysteretic Damper in Consideration of Stiffness Ratio

Dr. Daniel R. Teruna and **Mr. Hendrik Wijaya**
University of Sumatera Utara, Indonesia
Swinburne University of Technology, Australia

The application of hysteretic steel damper for seismic protection and rehabilitation has been recognized efficient and cost effective method in reducing structural responses under seismic events. The damper absorbs seismic energy through its hysteretic behaviour. This study aims to assess the vulnerability of building strengthened with hysteretic steel damper considering variability of stiffness ratio parameter in hysteretic steel damper for the application in six-story steel building. Probabilistic Seismic Demand Model (PSDM) for the structural model is developed by using nonlinear dynamic analysis under 30 ground motions. Furthermore, fragility curves are constructed based on inter-story drift and spectrum acceleration. Finally, the performance of the steel structure with and without hysteretic steel damper in addition to optimal stiffness ratio is presented and compared.



B021

Time: 16:25-16:40

Examining the Effect of Asphalt Plant Surplus Filler on Water Permeability, Chloride Ion Penetration and Electrical Resistance of Cement Mortar

Hadi Vafaeinejad, **Assoc. Prof. Mahdi Kioumarsi**
Oslo and Akershus University College of Applied Sciences, Norway

The penetration of water and chloride ion into the concrete is of factors that cause rust and corrosion in rebars by reaching the existing reinforcement surface in structures of reinforced concrete. The damage of reinforced concrete rebars not only results in weakening of the steel bearing load in each member but also causes stress inside the concrete in some cases. This stress can be a factor in starting and spreading cracks in the concrete. In this study, using Asphalt Plant Surplus Filler as a partial replacement of cement with replacement values of 0, 5, 10, 15 and 20%, were investigated and tested with the aim of decreasing cement consumption, permeability and electrical resistance of cement mortar. In order to determine the penetration of water, 10 cubic specimens with the size of 150 mm were studied. In order to determine chloride ion penetration, 20 cylindrical specimens with a length of 50 and a diameter of 100 mm were studied at the ages of 28 and 56 days. To test the electrical resistance, 30 cubic specimens with the size of 100 mm were tested at the ages of 7, 28 and 56 days. According to the results of the experiments, adding filler to the cement mortar enhances the penetration of water and chloride ion. This increased penetration has a gentle slope. In the electrical resistance test, this resistance generally increases with the increase of specimen age. Furthermore, the filler increment indicates the reduction of electrical resistance.

B3002

Time: 16:40-16:55

Compressive Behavior of Circular Concrete Columns Confined by Basalt Fiber Reinforced Polymer (BFRP)

Mr. Sakol Suon, Shahzad Saleem, Amorn Pimanmas
Sirindhorn Internation Institute of Technology, Thammasat University, Thailand

This paper presents an experimental study on the compressive behavior of circular concrete columns confined by a new class of composite materials originated from basalt rock, Basalt Fiber Reinforced Polymer (BFRP). The primary objective of this study is to observe the compressive behavior of BFRP-confined cylindrical concrete column specimens under the effect of different number of layers of basalt fiber as a study parameter (3, 6, and 9 layers). For this purpose, 8 small scale circular concrete specimens with no internal steel reinforcement were tested under monotonic axial compression to failure. The results of BFRP-confined concrete specimens of this study showed a bilinear stress-strain response with two ascending branches. Consequently, the performance of confined columns was improved as the number of BFRP layer was increased, in which all the specimens exhibited ductile behavior before failure with significant strength enhancement. The experimental results indicate the well-performing of basalt fiber in improving the concrete compression behavior with an increase in number of FRP layers.

B002

Time: 16:55-17:10

Pushover Analysis of Precast Segmental UHPFRC Bridge Columns with Unbonded Posttensioned Tendons

Mr. Zhen Wang, Jingquan Wang and Junzheng Zhu
School of Civil Engineering, Southeast University, China

Cyclic loading tests were carried out to research seismic behavior of precast segmental ultrahigh-performance fiber-reinforced concrete (UHPFRC) bridge column with unbonded posttensioned (PT) tendons. Energy dissipation (ED) bars embedded in ultrahigh-performance concrete (UHPC) grout maintained continuous across segment joints and unbonded at the bottom joint. The equivalent method was proposed for ED bars with unbonded length and unbonded PT tendons to obtain the equivalent fiber section conforming to the flat section assumption. A method based on the equivalent plastic hinge model was given to conduct pushover analysis for precast segmental UHPFRC bridge columns. Test results showed that all the specimens exhibited no less than 8% drift capacities, which were remarked with the first fracture of ED bars. Compared with test data, the proposed model was validated to have good accuracy to provide lateral skeleton curve.

B011

Time: 17:10-17:25

Preliminary Study of Sinabung Volcanic Ash Usage in the Making of Paving Block Type C and D

Ms. Rahmi Karolina, Syahrizal, M.Agung Putra, Bambang Nurdiansyah
Universitas Sumatera Utara, Indonesia

Based on the Volcanology and Geological Hazard Mitigation Center, Mount Sinabung itself is still at hazardous status up until now that can certainly erupt at any time and

sprayed a lot of volcanic material which will lead to the abundance of volcanic ash material in the area of Mount Sinabung. How to optimize the volcanic ash waste is what scientists need to think about. In this study, volcanic ash obtained from Mount Sinabung is used as substitution of fine aggregate in the manufacture of concrete brick (paving block). The variations used were 0%, 25%, 50%, and 75% of the starting weight of the fine aggregate used. From the test results, it is obtained optimum compressive strength of 25.2 Mpa and optimum water absorption of 5.998% which means concrete brick (paving block) meets the classification contained in SNI 03-0691-1996.

B3007

Time: 17:25-17:40

Effect of Fibre Content on Splitting-Tensile Strength of Wheat Straw Reinforced Concrete for Pavement Applications

Muhammad Usman Farooqi and **Assoc. Prof. Majid Ali**
Capital University of Science and Technology, Islamabad, Pakistan

Recent studies on compressive and flexural behavior of Wheat Straw Reinforced Concrete (WSRC) showed positive signs for increasing the toughness of concrete. This ultimately will help in reducing the micro-shrinkage cracking in rigid pavements. Splitting-tensile behavior is also an important property which needs to be investigated for WSRC. The overall aim of the research program is the development of economic and durable design for new rigid pavements by using locally available natural fibres in concrete. In this work, splitting-tensile strength of WSRC is investigated experimentally. To study the influence of wheat straw for having concrete with improved properties, Plain Concrete (PC) properties are taken as reference. The proportions of cement, sand and aggregates for PC and WSRC are taken as 1, 2 and 4, respectively. Wheat straw having length of approximately one-inch and contents of 1%, 2%, and 3%, by mass of wet concrete, are used to make WSRC. Water-cement ratios for PC and WSRC are taken as 0.55 and 0.60, respectively. Discussions on splitting-tensile behavior (strength, pre-cracked/cracked energy, and toughness index) of PC and WSRC specimen are made. It is concluded that splitting-tensile toughness index of WSRC is more than that of PC. As results seem favorable, so further study focusing on optimization of materials and durability of WSRC is recommended.

B3004

Time: 17:40-17:55

Improving the Tensile Energy Absorption of High Strength Natural Fiber Reinforced Concrete with Fly-Ash for Bridge Girders

Umair Aziz Khan,Hafiz Muhammad Jahanzaib, Mehran Khan**, Assoc. Prof. Majid Ali**
Capital University of Science and Technology, Islamabad, Pakistan

Nowadays high strength concrete is used in bridge girders due to its improved mechanical properties. However, its behavior is relatively more brittle compared to that of normal strength concrete. Due to the highest toughness among natural fibers, coconut fibers are chosen. In this work, the impact of different fly-ash contents on tensile absorbed energy of high strength coconut fiber reinforced concrete (CFRC-SF) will be investigated for structural application. The mix design ratio of CFRC-SF is 1:2:2 (cement: sand: aggregate) with a water-cement ratio of 0.50 and silica-fume content of 15%. The coconut fibers of 5 cm length and content of 2%, by cement mass, are added. To prepare CFRC-SF_5, CFRC-SF_{10} and CFRC-SF_{15}, different fly-ash contents of 5%, 10% and 15%, respectively, (by cement mass) are added. For determination of splitting-tensile strength, pre-crack/

absorbed energy after crack and toughness indices, cylinders of size 100 mm diameter and 200 mm height are cast and are tested under splitting-tensile load as per ASTM standard. The tensile absorbed energy of CFRC-SF is increased up to 10% fly-ash content. Further study on durability of CFRC-SF is suggested due to the biological nature of coconut fibers.

B026

Time: 17:55-18:10

Contribution of Sisal Reinforced Plaster in out of Plane Resistance of Masonry Column

Furqan Qamar, **Assoc. Prof. Majid Ali**
Capital University of Science and Technology, Islamabad, Pakistan

Nowadays to ensure sustainability low carbon emission environment friendly products are considered widely around the world. In the construction field, artificial fibres has been researched and used since long time. They are detrimental to the environment due to being non-degradable, non-renewable and high oil consumption. Therefore, there are thoughts to replace them with the natural fibres. In this paper, sisal fibre is considered and are used within 8 mm thick plaster of masonry column. In order to gauge the contribution of sisal fibre within plaster, comparison with unplastered and plain plastered columns are carried out. Two samples of each are considered. The outcome of the experiment revealed that the 8mm thick sisal reinforced plaster column was more ductile and it can be found 1200% and 27% improvement in failure load from unplastered and plain plastered column respectively, when subjected to out of plane lateral load.

B022

Time: 18:10-18:25

Conversational Bricks and The Future of Architecture: Will <Stores> Survive as the Epicenter for <Retail> Activity in Society?

Brian Subirana, **Ms. Nava Haghighi**, Dick Cantwell, Sanjay Sarma
Massachusetts Institute of Technology, USA

The most advanced IoT technologies enable giving physical objects human-like personalities and allowing humans to “converse” with them in any environment. In this paper, we explore the disruptive potential of adding conversational capabilities to any construction material such as bricks and in particular, explore retail and conversational commerce with the aim of designing physical spaces that can compete with e-commerce. We define conversational architecture as the design of buildings enabling human engagement with objects, physical environments, and virtual entities using conversational speech. In a time where digital content and virtual spaces are becoming more relevant through personalization and anticipation of needs, conversational commerce technologies can create a seamless experience between the digital and the physical, making both experiences more rich, while helping bring the relevance of digital experience to physical. In this paper, we will discuss open areas of research in conversational architecture through examining the enabling technologies and open problems that need to be addressed. We contend Conversational Architecture is a building technology that may ensure long-term sustainability of collective architecture and hope to accelerate research and policy discussions in this new and emerging field

B3006

Time: 18:25-18:40

Reliability and Economic Aspects of Restoring Interventions

Maurizio Nicolella, **Dr. Alessio Pino**
University of Naples Federico II, Italy

In building restoration the last decades have been characterized by a more and more active research of technological solutions that – almost in every case with the support of chemistry – could allow to perform interventions even in the situations where it was more opportune to execute demolitions and reconstructions.
The lack of a cost-benefit analysis, caused by issues of cultural approach, and the lack of evaluations in terms of reliability of the interventions of restoration executed, due to a lack of management during the period between the restoration intervention and the next failure, are producing situations of performance deficit which are bound to produce consequences not only on the economic balance, but also on the safety of the existing building heritage. A theoretical dissertation is followed by some emblematic examples.

Dinner@ *ITRI ITO Restaurant*

18:50-20:00

Date: 21 Jan. 2018(Sunday)

Time: 12:40-18:25

Venue: 5th Meeting Room

Time	
12:40-13:55	**Session D-1: *Mechanical and Manufacturing Engineering***
13:55-15:55	**Session D-2: *Material Physics***
15:55-16:10	*Coffee Break& Session P-2*
16:10-18:25	**Session D-3: *Biomedical Materials and Thermal Comfort***

Note:

* Please control each presentation time within 15 mins, including Q & A.
* The certification of Oral presentations, will be awarded at the end of each session.
* Best Presentation of each session is encouraged to award to student author prior.
* Winner of Best presentation will be announced at the end of each session and awarded winner certificate over the banquet on Jan. 21.
* To show respect to other authors, especially to encourage the student authors, we strongly suggest you attend the whole session.
* The scheduled time for presentations might be changed due to unexpected situations, please arrive meeting room at least 10 Mins before your Session starts.
* Session photo will be taken at the end of each session and updated online.

12:40–13:55, Sunday, 21 Jan.

Session D–1: Mechanical and Manufacturing Engineering

Venue: *5th Meeting Room*

Chair:

R087

Time: 12:40-12:55

Research on AC Power Conditioning Control Technology for Ultraprecision Machining of Steel Materials

Assoc. Prof. En-Chih Chang
Department of Electrical Engineering, I-Shou University, Taiwan, R.O.C.

This paper presents a nonlinear control technology controlled AC power conditioning with application to ultraprecision machining of steel materials. The presented technology associates the advantages of finite-time tracking control (FTTC) and cuckoo search algorithm (CSA). The FTTC allows insensitivity to system uncertainties as well as *system states finite-time convergence*. It is a remarkable fact that the chatter will occur in face of highly dynamic loads. The chatter causes high output-voltage distortion in AC power conditioning, and the ultraprecision machining of steel materials may be instability and unreliability. The CSA is thus used to attenuate the chatter so that the AC power conditioning can provide robust performance for ultraprecision machining of steel materials. Because the proposed control technology is easier to implement than prior technologies and achieves *high* tracking precision *and* low calculational-complexity algorithm, experiments display low total harmonic distortion and fast transience in the output voltage, and this paper will be helpful to researchers of related ultraprecision machining of steel materials.

R095-A

Time: 12:55-13:10

A Non-Contact Pneumatic Approach for Measuring Inner Roundness of Millimeter-Scale Metal Sleeves

Prof. Pensiri Tongpadungrod, Wiwat Maneekongkla, Chantaraporn Phalakornkule
King Mongkut's University of Technology North Bangkok, Thailand

This research work presents a non-contact pneumatic instrument for measuring inner roundness of a millimeter-scale metal sleeve. A nozzle of an air micrometer was located inside at the center of the sleeve. At an instant, the air micrometer injects an air jet stream toward inner wall of the metal sleeve, yielding a distance between the air jet nozzle and the inner wall of the sleeve, which was converted to the inner diameter of the metal sleeve based on its cylindrical geometry. As the air jet nozzle rotated 360 degree around the axis of the cylindrical sleeve sample, multipoint inner diameter data of the sleeve sample were collected. These diameters were used to construct inner roundness of the sample using the peak to peak criteria. In this study, the roundness of the metal sleeve sample were determined using the non-contact pneumatic instrument and were compared with those obtained by a commercial contact type roundness measuring instrument. The comparison showed good agreement (< 10% difference) when a workpiece was conforming (roundness < 1 μm). However, higher deviations were obtained when a workpiece was non-conforming (roundness > 1 μm).

R1013

Time: 13:10-13:25

3-D FEM Simulation of Laser Peening Straightening for Shaft Straightness

Dr. Boyong Su, Yongkang Zhang, Guifang Sun, Xu Pei, Ran Zhu, Zhonghua Ni
Jiangsu Key Lab Design & Mfg Micronano Biomed Ins, Southeast University, China

The straightness is an important indicator in measuring the quality of shaft parts. Laser peening straightening (LPS) is a new mechanical method to straight the shaft through inducing residual compressive stress into the shaft surface. Compared with the traditional method, the process of laser peening correction is high efficiency and can be controlled precisely. In the present work, the mechanism of laser peening straightening for shaft straightness is revealed and a three-dimensional finite model is developed to investigate the effects of laser parameters for shaft straightness correction. The results show that the peak pressure and pulse duration should be more than 4 GPa and 8 ns when laser peening straightening is used to correct the shaft straightness. The straightening amount increases with laser power density, laser pulse duration, multiple laser peening. The maximum correction amount for shaft straightness with LPS is no more than 0.01mm.

R129-A

Time: 13:25-13:40

Thermoplastic 3D Printing Molds for Restoration of Paper Cultural Heritage

Mr. Jonghyun Shin, Hyunji Lee and Jinho Hyun
Seoul National University, South Korea

Damaged paper was restored and reinforced with nanocellulose and pulp sludge using 3D printing. The template molds of thermoplastic polymers were printed using fused deposition modeling process and the space of molds was filled with new pulp material and nanocellulose. The polymer mold for 3D printing was designed from the digital image data of damaged paper. Pulp sludge with nanocellulose was used for the reinforcement of paper and the mold was used as a frame to confine the materials in it. The addition of nanocellulose enhanced the pulp suspension and formed a uniform thickness of sheet. The concentration of nanocellulose was determined by measuring the freeness of the pulp/nanocellulose mixed sludge. The performance of the reinforced paper was investigated with surface imaging and mechanical strength measurement.

R2004-A

Time: 13:40-13:55

Wire arc Additive Manufacturing of 5A06 Aluminum Alloy

Assoc. Prof. Zhi Zeng, Wang Zhimin, Bu Xianzheng, Sun Shaobo, Bei Peng
University of Electronic Science and Technology of China, China

Recently, 5A06 aluminum alloy, as a kind of high-strength (non-heat-treatable) Al-Mg alloy, is widely used in structural applications of energy, automobile, aerospace and aircraft due to its high strength-to-weight ratio, high hardness, good weldability and anti-corrosion performance. As one type of additive manufacturing (AM) techniques, wire arc additive manufacturing (WAAM) is a promising technology for fabricating metal components with complex structures. WAAM was successfully applied to produce 5A06 aluminum single tracks and thin wall-shaped parts in this investigation. The effects of welding current, travel speed and inter-track cooling time on the microstructures and forming characteristics were studied. It can be concluded that the geometrical features of

deposited tracks were remarkably affected by the heat input during WAAM process. An inappropriate combination of processing parameters could cause materials evaporation and melt pool instability, further resulting in occurrence of balling and distortion. The optimized manufacturing condition for 5A06 aluminum alloy were determined to be applied current of 102-140 A, travel speed of 6-14 mm/s and inter-track cooling time of 150 s according to microstructure and tensile tests. Dense parts were obtained under the optimal condition with few building defects. The microstructure of the deposits was homogenous, consisting of equiaxed α-Al grains with about 50μm in diameter. The tensile properties demonstrated directional independent. The average ultimate tensile strength of the horizontally built parts reached 315 MPa with the elongation of 21.1%.

13:55–15:55, Sunday, 21 Jan.

Session D–2: Material Physics

Venue: *5th Meeting Room*

Chair:

R034-A

Time: 13:55-14:10

Effect of Stacking Sequence on the Structure of PTCDI-C8/C8-BTBT Bi-layer

Ms. Aye Myint Moh, Seiji Watase, Tsutomu Shinagawa and Masanobu Izaki
Toyohashi University of Technology, Japan

Optoelectronic devices of organic light emitting diodes, organic field effect transistors, and organic photovoltaics have been fabricated by stacking some layers including p- and n-type semiconductor layers, and the performance closely relates to the preferred orientation and structure including the morphology of the resultant bi-layer structure. In this study, the effect of the stacking sequence on the preferred orientation and morphology of p-type 2,7-dioctyl [1] benzothieno [3,2-b] benzothiophene (C8-BTBT)/n-type organic semiconducting molecule N,N'-dioctyl-3,4;9,10-perylene tetracarboxylic diimide (PTCDI-C8) bi-layer was investigated with X-ray diffraction and kelvin-force microscopy observations.
The mono-layers and bi-layers of 100-nm-PTCDI-C8 and 100-nm-C8-BTBT layers were deposited on single crystal C sapphire (0001) Al2O3 substrate by a vacuum thermal evaporation at the rate of 0.1 nm/s and substrate temperature 343 K.
Conventional /2 X-ray diffraction method and single crystal X-ray diffraction method by using imaging plate were used to analyze the structural characterization. The (001)-out-of-plane orientation was developed for both PTCDI-C8 and C8-BTBT layers irrespective of mono-layer and bi-layers. And, similar spot pattern could be observed on imaging plate regardless of the stacking sequence, suggesting the formation of preferred orientation including the in-plane and out-of-plane orientation. The C8-BTBT layer was composed of island grains and the under continuous layer with relatively large surface irregularity, and the continuous PTCDI-C8 layer with smooth surface could be obtained on the C-sapphire substrate. The surface potential estimated by KFM was so different for C8-BTBT and PTCDI-C8 layers, respectively. The different configurations of deposited p-n or n-p hetero bilayer structure of C8-BTBT and PTCDI-C8 layers showed clear differences not only in morphologies but also in the surface potential of the layers. The surface potential changed by stacking another upper layer on the bottom layer directly deposited on C-sapphire substrate. The upper C8-BTBT/PTCDI-C8 bottom bi-layer showed smooth surface and almost constant surface potential over the surface without island grain formation, suggesting the formation of defect-free C8-BTBT/PTCDI-C8 bi-layer. The upper PTCDI-C8/C8-BTBT bi-layer showed a large surface irregularity and heterogeneous distribution of surface potential, suggesting the formation of poor quality bi-layer. The bottom organic semiconductor layer has a strongly influence on the structure and homogeneity of the subsequent upper organic semiconductor layer and resultant bi-layer.

R039

Time: 14:10-14:25

Lead Free Bi1/2Na1/2TiO3 - CoFe2O4 Magnetoelectric Nanoparticulate composite Thin Films Prepared by Chemical Solution Deposition Method

Mr. Vinod Kumar, Dr. Mintu Tyagi
Desh Bhagat Unversity, Punjab India,India

Magnetoelectric (1−*x*) BNT−*x* CFO nanoparticulate thin films with (*x* = 0, 0.1, 0.2, 0.3) were fabricated by a chemical solution deposition technique. The X-ray diffraction shows that no other secondary phases are observed. Transmission electron microscope (TEM) revels that CFO nanoparticles were well distributed in matrix of BNT. The nanocomposite films exhibit both good magnetic and ferroelectric properties at room temperature (*R-T*), as well as enhanced magnetoelectric coupling. The composite with *x* = 0.2, showed the large value of *ME* voltage coefficient (α_E) ~ 163 mV/cmOe. These *ME* composites provide a great opportunity as potential lead free systems for *ME* devices.

R050-A

Time: 14:25-14:40

Geometrically Nonlinear Characteristics for Control of Piezoelectric Composite Multilayer Plates

Mr. Jung Soo Rhim and Ji-Hwan Kim
Seoul National University, South Korea

In this paper, the mechanical properties of composite laminate plates are investigated with piezoelectric extensional actuators using various micromechanical models. The structure is based on the first-order shear deformation theory of plates (FSDTP), and the model is subjected to the surface forces resulting from the axial strain of the actuators. Prior to the structural analysis, validations of the micromechanical material properties are performed to compare with the present work and experimental data. And then, using the finite element method with micromechanical properties, the deflections of the multi-layer composite structure including the piezoelectric materials are obtained using the material properties under a uniformly distributed static load for a range of voltages. Furthermore, a geometrically nonlinear problem of the structural model based on the von Karman theory of plate is analyzed using the Newmark-β method. In the work, the top and bottom piezoelectric layers are the role of a sensor and an actuator, respectively. Through comparison with data from previous works, the present model yields a reasonable numerical data. Also, the mechanical properties obtained from the micromechanical model are in good agreement with the experimental data. Moreover, there is a clear trend that the deflections, natural frequencies and active control response using the effective moduli are consistently larger than that using experimental moduli. This shows the trend that the micromechanical models result in more flexible simulations of the structure. Finally, the active control of the model is observed at various feedback gain values and with mechanical properties obtained from both experimental and micromechanical data. With a higher feedback gain value, the composite structure with piezoelectric sensor and actuator stabilizes at a higher rate.

R072-A

Time: 14:40-14:55

FDTD Simulation: Design of Refractive Index and Single-Object Sensing Using a Whispering-Gallery-Modes Microring Coated with a high-Refractive-Index Film

Assoc. Prof. Zhi-Hong Zhang, Si-Hui Shang, Mu-Neng Li and Shao-Yi Wu
School of Physical Electronics, University of Electronics Science and Technology of China, P.R. China

Sensing of whispering-gallery-modes in a microring resonator coated with a high-refractive-index film is modeled using the 2D finite-difference time-domain method.

A short pulse with ultrawide bandwidth in the high-index film spans the circumference of the ring. The spectra of the high-index film and the pulse propagation in time domain were simulated. The results indicate redshifts of the resonance wavelengths with an increasing refractive index inside the ring. A sensitivity of 28.5 nm/RIU is found for the index of 1.48. An obvious splitting or broadening of resonant modes is obtained for sensing a single object in the channel of the microring of high refractive index because of scatter due to the multiple interactions between the light and the sensing object. This phenomenon can be used for detection of the size and number of particles. For single particles with a radius of 3 μm, the mode splitting is increased with increasing number of particles from one to nine, and the quality factor is decreased inversely with increasing number of particles. The estimation of the size of the particles is based on their polarizability because the splitting of the mode of the optical field in the ring depends on the polarizability. This work reveals the potential applications of whispering-gallery-modes in a microring resonator coated with a high-index film for sensing one or multiple objects and even a single molecule.

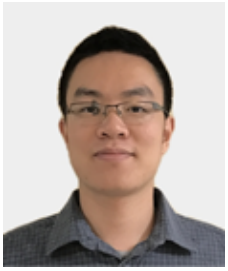
R1007

Time: 14:55-15:10

Fabrication of Pickering Emulsion Polymerized Magnetic Composite Particles and Their Magnetorheological Response

Prof. Hyoung Jin Choi
Inha University, Korea

Magnetorheological (MR) suspensions, tunable colloidal complex fluids of magnetic particles dispersed in nonmagnetic liquid, become solid-like under an applied magnetic field from their initial liquid-like state without a magnetic field. Their rheological properties can instantly be changed as a result of building up a chain-like structure of the dispersed magnetic particles under a magnetic field due to magnetic dipole-dipole interaction between particles, attracting their various engineering applications. In this study, we fabricated core/shell-structured magnetic polymer composite particles by Pickering emulsion polymerization using nanosized either maghemite or magnetite particles as a solid emulsifier for either polystyrene or poly(methyl methacrylate) system. These core-shell structured composite particles were applied as smart materials for magnetorheological (MR) fluids for various rheological studies under applied magnetic field strengths. The synthetic particles were also added into micron-sized carbonyl iron based MR fluid as an additive. MR characteristics of these systems with or without additives were also investigated along with their sedimentation stability.



R056-A

Time: 15:10-15:25

Synthesis and Optical Properties of Ultra-small ZnO Nanoparticles

Mr. Yuhang Sun, Preston Donaldson, Sarah Swisher
University of Minnesota Twin Cities, USA

In the past decade, an extraordinary effort has been directed towards group II-VI semiconductors. Among these, ZnO is considered an indispensable candidate for developing next-generation transparent electronic devices. ZnO has been extensively utilized in devices such as gas sensors [1], acoustic wave devices [2], and thin film transistors [3]. New fabrication methods for ZnO thin films are being explored, and the optical properties of such films are of significant interest. In recent years, good quality ZnO thin films have been fabricated using molecular beam epitaxy [4], magnetron sputtering [5], pulsed laser deposition [6], and the sol-gel process [7]. Colloidal

nanoparticles provide high-quality crystalline oxide material that is solubilized by long-chain organic ligands in organic solvents. The size and shape of colloidal nanoparticles can be adjusted during synthesis, and their surface properties can be modified as well. Thus, colloidal nanocrystal synthesis offers a route towards well-controlled phase-pure semiconductor oxide materials. Unfortunately, so far there are few studies about the optical properties of colloidal ZnO nanocrystals and films, even fewer reports was seen in ultra-small size region (~7.0 nm) where ZnO will show strong quantum confinement effects [8]. In this work, we have successfully synthesized uniform, ultra-small ZnO nanocrystals capped with 1-dodecanethiol. Zinc acetate and NaOH were dissolved in isopropanol separately, then NaOH was added to the zinc acetate solution and stirred at 60℃. 1-Dodecanethiol was added to encapsulate the particles, and the final mixture was held at 60℃ for 1 hour. The nanostructure of the prepared ZnO nanoparticle has been confirmed using TEM and SAED analyses. The obtained ZnO nanoparticles have zincite structure (hexagonal system) with crystalline size of ~4.0 nm. The optical characteristics of nanocrystalline ZnO thin films have been investigated via variable angle spectroscopy ellipsometry (VASE) over a wide wavelength range (200-1200 nm) at room temperature. The optical constants and film thickness were obtained by analysis of the measured ellipsometric spectra through Cauchy-Urbach model. The experimental and fitted data are found to be excellent agreement. Optical band gap of the films has been derived from the classic square law and it's found to be ~3.66 eV compared with bulk ZnO of 3.37 eV, which demonstrate a clear quantum confinement effect.

R1028

Time: 15:25-15:40

Sintering Effect on Magnetite-to-Hematite Structural Conversion of As-Prepared Fe2+Cr0.2Fe1.8O4 nano-ferrites

M.A. Amer, A. Matsuda, G. Kawamura, T. Meaz, R. El-Shater and **Ms. F. Fakhry**
Tanta University, Egypt

This research presents effect of sintering temperature T and structural transition process on magnetic and optical properties of as-prepared magnetite $Fe^{2+}Cr_{0.2}Fe_{1.8}O_4$ Nano-ferrites which synthesized by Co-precipitation method and sintered at different T. Structural phase of crystal lattice was converted from-cubic magnetite-to-maghemite-to-hexagonal hematite with T. Specific surface area S revealed decrease against crystallite size R. Saturation magnetization M_S proved dependence on R and porosity P. Strain behavior Ɛ enhanced band gap energy E_g.

R106

Time: 15:40-15:55

Preparation and Characterization of Magnetic Force Microscopy Tips Coated with Nickel Films by E-Beam Evaporation

Badin Damrongsak, **Mr. Samutchar Coomkaew**, Karnt Saengkaew, Ittipon Cheowanish and Pongsakorn Jantaratana
Silpakorn University, Thailand

In this work, magnetic force microscopy (MFM) tips coated with a nickel thin-film were prepared and characterized for applications in the measurement of the magnetic write field. Nickel films with various thicknesses in a range of 20 – 80 nm were deposited on silicon substrates and silicon atomic force microscopy (AFM) tips by electron beam evaporation. Film surface morphologies and magnetic properties of the coated nickel films were investigated by using AFM and vibrating sample magnetometry (VSM). The rms roughness increased with the film thickness and was in a range between 0.1 and 0.3 nm.

VSM results revealed that the mean coercive field of the nickel films was 20 Oe and there was an increase in the coercivity as the film thickness increased. In addition, the prepared MFM tips were evaluated for the tip response to the dc and ac magnetic field generated from perpendicular write heads. It was found that the MFM tip had the best response to the write field when coated with 60 nm thick nickel film. The coating thickness over 60 nm was inapplicable due to the cantilever bending caused by the film stress.

Coffee Break& Session P-2

15:55-16:10

16:10–18:25, Sunday, 21 Jan.

Session D–3: Biomedical Materials and Thermal Comfort

Venue: *5th Meeting Room*
Chair:

R024

Time: 16:10-16:25

Development for Wound Dressing Based on Blended Chitosan and Gelatin Hydrogels

I-Hao Chen, Ching-Ming Chien, Chun-Ting Wang, **Dr. Chih-Ling Huang**, Chih-Kuang Wang, and Yur-Ren Kuo
Center for Fundamental Science, Kaohsiung Medical University, Taiwan

Chitosan and gelatin are potential wound dressing materials. However, chitosan takes too much time to degrade and gelatin degrades too fast. As a result, chitosan and gelatin are blended to adjust their degradation rate. The degree of degradation test by means of weight loss and thermogravimetric analyzer after being incubated with lysozyme, which is a common enzyme in body fluid. Optical microscopy was used to observe the materials morphology after immersed in water. Finally, fibroblast cells were cultured with various material extracts to examine cell adhesion *in vitro*. Cell adhesion tests showed there are no negative effect on cells. Therefore, there is no cell toxicity of chitosan on cells. Chitosan and gelatin can be promising wound dressing raw materials in future.

R032-A

Time: 16:25-16:40

Direct Growth of Graphene on NiTi Alloy for Reduction of Magnetic Resonance Artifact

Mr. Taeyang Han and **Prof. Jun Hyun Han**
Chungnam National University, South Korea

Magnetic Resonance Imaging (MRI) has been used to make a diagnosis and to monitor response to chemotherapy in patients with local disease. However, if there are biomedical implants or components in human body, they can distort the magnetic resonance (MR) image of the implants and components, and then form MR artifact. The MR artifact occurs due to the difference in the magnetic susceptibility between the biomaterials and the human tissue. Human tissue has diamagnetic property, while, the well-known biomaterials such as titanium, nitinol (NiTi alloys), and Co-Cr alloys have strong paramagnetic property. Therefore, in order to mitigate the MR artifact, it is necessary to reduce the strong paramagnetic property of the biomaterials to meet the magnetic susceptibility of the human tissue. In this study, to reduce the magnetic susceptibility of the NiTi alloy that widely used as a biomaterial, graphene that has superior diamagnetic property and biocompatibility was coated on NiTi alloy. We report the direct growing of graphene on NiTi alloy by chemical vapor deposition (CVD) without using a catalyst, and analyzed the magnetic susceptibility of NiTi/graphene composites.

R037

Time: 16:40-16:55

Fabrication of Mesoporous Bioactive Glass Nanoparticles by Sol-gel Method

Wei-Wen Lin, Wei Fang, I-Hao Chen, Tze-Yo Hung, and **Dr. Chih-Ling Huang**
Center for Fundamental Science, Kaohsiung Medical University, Taiwan

Bioactive glass (BG) is characteristic of its great biocompatibility as well as osteoconductivity. Application of BG after surgery (e.g., tumor resection) aids rehabilitation of previously traumatized area, promotes bone regeneration, and prevents aggravation of wounds. In this *in vitro* study, bioglass nanoparticles (BGN) were successfully produced via sol-gel method. We observed the morphology of BGN through Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). Particle size was measured by Dynamic Light Scattering (DLS): 182.9 nm ± 37.7 nm in diameter, which corresponds to images obtained by SEM and TEM. We then synthesized BGs containing different proportions of Ca and P ions. Under different pH values, gels with various morphologies were formed.

R081-A

Time: 16:55-17:10

Bacteria and Cysteine Induced Discoloration in Mineral Trioxide Aggregate

DEOGGYU SEO

Seoul National University, South Korea

Methods: In this study, Five groups with OrthoMTA (BioMTA, Seoul, Korea) specimens were used: Group I; BHI + MTA (control group), Group II; E. feacalis + MTA, Group III; BHI + Cysteine + MTA, Group IV; BHI + E. faecalis + MTA, Group V; BHI + E.feacalis +Cysteine + MTA. OrthoMTA were prepared into 50 disk-shaped specimens by using disc zig (diameter 10mm, thickness 2mm). They were divided each group (n=10) and submerged in five different conditions depending on each group for 24hrs. After 24 hrs, photos were taken and shade change was evaluated using a spectrophotometer. The significance of the result was statistically analyzed by one-way ANOVA and Tukey test ($p<0.05$).
Results: In cysteine containing solution, MTA specimens showed statistically significant black discoloration. In case of E. feacalis containing without cysteine, MTA specimens showed statistically significant black compare to control group but showed less black color than group III and V those are containing cysteine.
Conclusion: E. feacalis and cysteine induced the discoloration in OrthoMTA containing bismuth oxide.

R2015

Time: 17:10-17:25

Surface Modification for Detection of Liver Cancer Biomarker

Asst. Prof. Thidarat Wangkham

King Mongkut's University of Technology North Bangkok, Thailand

Materials modification with surface functional group for bioactive film or sensor surface is important in many applications. A suitable surface for each system can be shown high efficiency of detection. In this work, two different surfaces via covalent binding are created on gold substrate for finding the suitable surface in medical applications. The liver cancer biomarker, alpha-fetoprotein (AFP) was detected on two surfaces; one is carboxy dextran and another is a modified polymethyl metacrylate (PMMA). The substrates were improved by physical and chemical binding for AFP antibody immobilization. Contact angle and surface Plasmon resonance (SPR) were used to study the characteristic of surfaces. The result was found that the carboxy dextran gave higher detection than PMMA. Moreover, the dextran surface was studied in real serum samples. It was shown the significantly different between positive and negative AFP serum which is preliminary results for testing in more clinical samples further.

R038

Time: 17:25-17:40

Investigation of Microclimate in Sports Shoes with the Integration of Human Subjective Sensations

Dr. Annie Yu, Pui Ling Li, Kit Lun Yick, Sun Pui Ng and Joanne Yip
Institute of Textiles and Clothing, The Hong Kong Polytechnic University, HK

Thermal comfort is an important criterion for the overall wear comfort of shoes. In this study, the materials properties, the microclimate of two types of sport shoes made of leather and mesh spacer fabric were evaluated. The human subjective sensations when wearing the shoes were investigated. Ten youth and ten elderly subjects have taken part in wear trials that consist of three activities: sitting, walking and running, while wearing the two types of shoes and in the barefoot condition. The order of the wear trials is randomized for each subject. The temperature and humidity at six locations of the foot were recorded during the wear trials and subjective perceptions of thermal, humidity and comfort were rated at the end of each wear trial. The results show that the leather sports shoes trap more heat and moisture on the feet than the mesh fabric sports shoes. The effect is more significant during running. Therefore, the shoe upper materials not only affect the temperature and humidity of the foot dorsal but also those of the foot plantar. Gender, foot condition and type of activity have a significant linear relationship with thermal, humidity and comfort perceptions towards footwear. Age does not have any impact on the three subjective perceptions. The findings in this study can therefore act as a reference source for the design and development of footwear that have better wear comfort.

R068-A

Time: 17:40-17:55

Hydrothermal Synthesis, Crystal Structures, and Enantioselective Adsorption Property of Bis(L-histidinato)nickel(II) Monohydrate

Christian Paul Ramos and Marlon Conato
University of the Philippines Diliman, Philippines

Despite the numerous researches in metal-organic frameworks (MOFs), there are only few reports on biologically important amino acids, histidine in particular, on its use as bridging ligand in the construction of open-framework architectures. In this work, hydrothermal synthesis was used to prepare a compound based on Ni2+ and histidine. The coordination assembly of imidazole side chain of histidine with divalent nickel ions in aqueous condition yielded purple prismatic solids. Single crystal X-ray diffraction (XRD) analysis of the product revealed structure for Ni(C6H8N3O2)2 • H2O that has a monoclinic (C2) structure with lattice parameters, a = 29.41, b = 8.27, c = 6.31 Å, β = 90.01 ˚. Circular dichroism – optical rotatory dispersion (CD-ORD), Powder X-ray diffraction (PXRD) and Fourier transform – infrared spectroscopy (FT-IR) analyses are conducted to further characterize the crystals. Enantioselective adsorption analysis using racemic mixture of 2-butanol confirmed bis(L-histidinato)nickel(II) monohydrate MOF crystal's enantioselective property preferentially favoring the adsorption of (S)-2-butanol isomer.

R101-A

Time: 17:55-18:10

Advanced Electron Microscopy for Halide Perovskites: Discovering New Structures

Dr. Yi Yu and Peidong Yang
ShanghaiTech University, China

Halide perovskites have great potential for many applications such as high-efficiency photovoltaic cells. Research addressing these materials, in particular their nanostructures, has recently attracted worldwide attention. We have successfully synthesized and characterized two-dimensional (2D) ultrathin inorganic and organic-inorganic hybrid halide perovskite nanomaterials [1,2]. Advanced electron microscopy enabled structural exploration on the atomic-level and new structures were discovered in this manner. As an example, we show the direct observation of unusual structure in 2D inorganic halide perovskite nanosheets, which could be interpreted as the Ruddlesden-Popper (RP) phase based on model simulations [3]. Considering RP phase is well known in oxide perovskites and is related to many interesting properties such as superconductivity and ferroelectricity, while RP phase has not yet been discovered in inorganic halide perovskites before, our finding marks a major advance toward future inorganic halide RP phase synthesis and theoretical modeling, as well as unraveling their structure−property relationship.

R2001

Time: 18:10-18:25

Effect of Titanium and Molybdenum Addition to Aluminum on its Grain Size, Mechanical Behavior, Mechanical Characteristics and Ductility

Prof. Adnan I. O. Zaid, Hashem Alkhalidi and Shanaz M. Alkhali
Industrial Engineering Department, the University of Jordan, Jordan

Aluminum and its alloys are the second most commonly used metal for a variety of engineering applications. They solidify in columnar structure with large grain size which normally affects their mechanical behavior and surface quality. Therefore, it is essential to refine their grain size to overcome these discrepancies. The most used method is by the addition of Ti, Ti-B or other rare earth elements. In this paper, the effect of Ti and Mo addition to commercially pure aluminum on its grain size, mechanical behavior, mechanical characteristics and ductility is investigated.

Dinner@ *ITRI ITO Restaurant*

18:50-20:00

Poster Presentation

Date: 20 Jan. 2018(Saturday)

Time: 14:45-15:25

Venue: Coffee Break Area

Time	
14:45-15:25	**Session P-1: *Material Science and Civil Engineering***

Note:

* The certification of Poster presentations, will be awarded at the end of each session.
* Best Presentation of each session is encouraged to award to student author prior.
* Winner of Best presentation will be announced at the end of each session and awarded winner certificate over the banquet on Jan. 20.
* To show respect to other authors, especially to encourage the student authors, we strongly suggest you attend the whole session.
* Session photo will be taken at the end of each session and updated online.

No.	Paper ID	Title
01	**R003-A**	Synthesisi and Properties of Polypropylene with Amine Functional Microcrystalline Cellulose (MCC) as Carbon Dioxide Adsorbable Filler
02	**R004-A**	Preparation, characterization and mechanical properties of bio-polyurethane composites reinforced with amine functional microcrystalline cellulose
03	**R008-A**	Influence of chemical composition on structure and optoelectronic properties of Cu–Cr–O thin films deposited by reactive magnetron sputtering
04	**R036-A**	Synthesis and application of stretchable electrode made of polymeric nanofiber and inorganic nanoparticles
05	**R052-A**	Active Sites of Carbon Blacks Characterized using Temperature Programmed Desorption
06	**R055**	Enhanced Formation of the Carbon Microcoils by the Stepwise type Manipulation of CS2 Flow Injection
07	**R059**	Withdrawal Resistance and Failure Mode of Semi-Circular Wooden Composite with Different Fasteners
08	**R075-A**	Terahertz Techniques of Measurements in Painting Thickness on the Composite Materials
09	**R079-A**	Photoactivity enhancement by natural convection control in hydrothermal synthesis of iron oxide nanorods
10	**R082-A**	Hemispherical array of Colloidal Crystals fabricated by thermal transfer printing method
11	**R1009**	Influence of Process Parameters of 316LN Hot Wire Filling Laser Welding on the Blunt Edge Layer Forming Quality
12	**R3018**	Numerical simulation study of collision effect on damage evolution in electromagnetic forming of Aluminum alloy
13	**EM2004**	Design of alternating current abrasive magnetic fluid jet generator based on permanent magnet

14	**EM3004-A**	Characteristics of 15-mode Piezoelectric Ceramic-Epoxy Composite
15	**R116-A**	Microstructures and Reheating Characteristics of Semi-solid AC7A Al Alloy for Thixo-forming
16	**R127-A**	Phosphorescence Organic Light-Emitting Diodes Using a Graphene Oxide as Hole Injection Layer
17	**R128-A**	Crystal Structure and Microstructure of Metal Carbides in Ni Superalloy
18	**R2002-A**	A Study of Adhesive properties and FEM Analysis of Multi Materials for Lightweight Center Floor
19	**R3014**	The Electromechanical Behavior of Dielectric Elastomer Actuator Stiffened by Fiber
20	**R101-A**	Advanced Electron Microscopy for Halide Perovskites: Discovering New Structures
21	**R096**	"Effects of Gold nanoparticles on fluorescence polarization and emission spectra of Rhodamine 6G solution"
22	**R108-A**	Study on Thermal Degradation Behavior of Composites of Liquid Crystalline Epoxy with Silica
23	**R114-A**	Rapid, thermostable antimicrobial peptide-mediated synthesis gold nanoparticles as highly efficient charge trapping medium for sol-gel-derived thin film
24	**EM3005-A**	Formation of Optical Fiber Preform using OMCTS
25	**R099-A**	A Study on the Strength Properties of Cement Mortar Containing Cellulose Nanocrystals and Cellulose Nanofibrils
26	**R071**	Fabrication of lightweight concrete composites using natural fibers in Thailand
27	**B022**	Conversational Bricks and The Future of Architecture: Will <Stores> Survive as the Epicenter for <Retail> Activity in Society?
28	**B004**	Wind-induced vibration response analysis of FRP bracket-line coupling system
29	**B005**	Research on the connection property of bonded steel sleeve connection for full-scale composite member
30	**B013-A**	Experimental Study on Condition of Early Age Concrete Member with Nondestructive Tests Technique
31	**B024-A**	Ultimate Strength Comparison of Base Metal Fracture in Welded Connection with Duplex Stainless Steel with Low Nickel
32	**B023-A**	An Estimation of Compressive Strength of Concrete Depending on Steel Fiber Volume Fractions with Non-destructive Tests Method
33	**B3003**	Application of Redundancy to Steel Box Tied Arch Bridge Structural System
34	**B014**	Analysis of Energy Consumption by Geothermal Heating and Cooling Systems and Building Integrated Photovoltaic Systems (BIPV) for College Building

14:45–15:25, Saturday, 20 Jan.

Session P–1: Material Science and Civil Engineering

Venue: ***Coffee Break Area***
Chair:

R003-A

Synthesisi and Properties of Polypropylene with Amine Functional Microcrystalline Cellulose (MCC) as Carbon Dioxide Adsorbable Filler

Ms. Hanna Kim, Yeokyung Yang, **Ms. Juhyung Lee**, Kiseob Hwang and KiRyong Ha
Keimyung University, South Korea

Packaging film wraps for coffee beans, vegetables, or fermented foods often rupture dueto the carbon dioxide generated during distribution or transportation processes, This may cause permanent failure to the protective film and lead to product contamination. In order to resolve this problem, carbon dioxide adsorbable fillers were prepared for the packaging materials, and their physical properties were characterized by compounding polypropylene (PP) composites. In this research, modified biodegradable microcrystalline cellulose (MCC) powders with trimethoxysilylpropyl modifed polyethyleneimine (TPPI) silane coupling agents were prepared, where the amino functional group contributes CO2 adsorbable moieties. After silanization, surface treated MCC fillers were melt blended with polypropylene (PP) random copolymer using maleic anhydride grafted PP (MA-g-PP) as compatibilizer to prepare PP/MCC composites.
We measured the degree of surface functionalization of MCC using Fourier transform infrared spectroscopy (FTIR), X-ray photoelectron spectroscopy (XPS) and elemental analysis (EA) techniques. The adsorption amount of CO2 on the surface modified MCC powders was analyzed by thermogravimetric analyzer (TGA). Mechanical properties of composites were measured by universal testing machine (UTM), and the compatibility between MCC powders and LDPE was investigated at their interfaces by scanning electron microscope (SEM). As a result, MCC powders modified with TPPI showed higher tensile strength, elongation at break and modulus due to higher compatibility with PP base polymer compared to pristine MCC filler powder.

R004-A

Preparation, Characterization and Mechanical Properties of Bio-Polyurethane Composites Reinforced with Amine Functional Microcrystalline Cellulose

Ms. Yeokyung Yang, Hanna Kim, Juhyung Lee, Kwang-Hee Lim and **Prof. Kiryong Ha**
Keimyung University, South Korea

In this study, the surface of biodegradable microcrystalline cellulose (MCC) powders was modified with 3-aminopropyltriethoxysilane (APS) or (3-trimethoxysilylpropyl)diethylenetriamine (TPDT) silane coupling agent to introduce amino groups on the surface by silanization. After mixing surface modified MCC powders in bio-polyol, precursors were reacted with 4,4’-methylenebis(phenyl isocyanate) (MDI) to synthesize prepolymer, and chain-extended with 1,4-butanediol to prepare bio-polyurethane (PU) composite. The amount of APS or TPDT grafted on MCC powder surface and the formation of chemical bonds were confirmed by Fourier transform infrared spectroscopy (FTIR), elemental analysis (EA), X-ray photoelectron spectroscopy (XPS) and thermogravimetric analysis (TGA).

The effect of APS or TPDT modified MCC (MCC-APS or MCC-TPDT) filler on various properties was studied using a universal testing machine (UTM) and differential scanning calorimetry (DSC), and interfacial binding between modified MCC powder and the bio-PU matrix was characterized by scanning electron microscope (SEM). We observed an increase in tensile strengths and moduli with increasing MCC-APS or MCC-TPDT contents in bio-PU composites, due to the strong urea bond formed at the interface between the MCC-APS or MCC-TPDT and the bio-PU matrix.

R008-A

Influence of Chemical Composition on Structure and Optoelectronic Properties of Cu–Cr–O Thin Films Deposited by Reactive Magnetron Sputtering

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National Chung Hsing University, Taiwan, Republic of China

Cu–Cr–O films were prepared by DC magnetron co-sputtering using Cu and Cr targets on quartz substrates. The films were annealed at 700 ℃ for 2 h under controlled Ar atmosphere. [Cu]/[Cr] ratio was increased from 0.59 to 2.02 by increasing the Cu-target power from 10 W to 52 W. When the film was prepared at Cu-target power of 10 W, a pure spinel CuCr2O4 phase was formed in the film. As the Cu-target power increased to 22 W, the phase transformed gradually from spinel CuCr2O4 to delafossite CuCrO2. Further increase of Cu-target power resulted in the appearance of an additional monoclinic CuO phase. The [Cu]/[Cr] ratio was approximately 1 at Cu-target power of 22 W, which caused the film to exhibit pure delafossite CuCrO2 phase and high crystallinity. Accordingly, optimum conductivity and transparency were achieved for the pure CuCrO2 film deposited at Cu-target power of 22 W with a figure of merit of 1.51 × 10−8 Ω−1 (i.e., electrical resistivity of up to 5.13 Ω-cm and visible light transmittance of up to 58.31%). Co-sputtering technology by changing target power is an effective tool and a feasible method for preparing pure spinel CuCr2O4 and delafossite CuCrO2 thin films.

R036-A

Synthesis and Application of Stretchable Electrode Made of Polymeric Nanofiber and Inorganic Nanoparticles

Prof. Jungkyun Im
Soonchunhyang University, Republic of Korea

Here we introduce a conductive composite mat of silver nanoparticles and rubber fibers that allows the formation of highly stretchable circuits through a fabrication process that is compatible to any substrate and scalable for large-areas applications. Silver nanoparticle precursor is absorbed in electrospun poly(styrene-block-butadiene-block-styrene) (SBS) rubber fibers and then converted into silver nanoparticles directly in the fibers mat. Percolation of the Ag nanoparticles inside the fibers leads to a high bulk conductivity which is preserved at large deformation for a 150 μm-thick mat. We design electric circuits directly on the electrospun fibers mat by nozzle printing, ink-jet printing, and spray printing of the precursor solution and fabricate a highly stretchable antenna, a strain sensor, and a highly stretchable light-emitting diode as examples of applications.

R052-A

Active Sites of Carbon Blacks Characterized using Temperature Programmed Desorption

Mr. Chang Chia-Min and Lin Jarrn-Horng
National University of Tainan, Taiwan

Carbon black is a kind of carbon nanomaterial widely used as a filler in rubber reinforcement. However, characterization of the active sites of carbon black is still a challenge. Here, we use a simple method-temperature programmed desorption (TPD) to investigate the active sites of carbon blacks (N110, N220, N330...etc) by various probe molecules, e.g. toluene, ethanol, and isopropyl alcohol. Toluene-TPD results depict that carbon black with higher specific surface areas displaying higher desorption temperatures. Higher specific surface area is an index of higher disorder structures of carbon blacks. This indicates that highly disorder structures of carbon black would present stronger interaction with probe molecules. The adsorption behavior of toluene on carbon black is approximately a first-order reaction, which shows that toluene only adsorbed on the higher active sites of carbon blacks. The desorption behaviors of ethanol and isopropyl alcohol are under studying. We believe that different polar molecules adsorbed on carbon blacks will display unlike adsorption behaviors through different active sites. Our results will provide new insights for the characterization of active sites for carbon blacks and their applications in rubber reinforcement.

R055

Enhanced Formation of the Carbon Microcoils by the Stepwise type Manipulation of CS2 Flow Injection

Ms. Na-Young Lee, Sung-Hoon Kim
Silla University, Republic of Korea

Carbon coils were synthesized using C_2H_2 as source gas and CS_2 as an incorporated additive gas under the thermal chemical vapor deposition system. The flow rate of CS_2 varied according to the different reaction processes. Geometries of as-grown carbon nanomaterials were developed from vine-type into coil-type with increasing CS_2 flow rate from 5 to 20sccm. Above 20sccm of CS_2 flow rate, indeed, most of them were appeared as the tiny-sized wavelike nanocoil type geometries. To develop the double helix-type microcoils, namely the carbon microcoils, the injection of CS_2 flow was manipulated as the stepwise type on/off-cycle manner. Under the specific condition of the on/off-cycle number, the density of the carbon microcoils was enhanced. The cause for the enhanced formation density of the carbon microcoils by the stepwise type manipulation of CS_2 flow injection was suggested and discussed.

R059

Withdrawal Resistance and Failure Mode of Semi-Circular Wooden Composite with Different Fasteners

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National Taiwan University of Science and Technology, Taiwan

Wooden Composite is assembled with semi-circular waste wood by fastener, in order to provide local Indonesian affordable construction components potentially. Considering wooden composite, the withdrawal resistance affect the shear resistance ability under short-term lateral load, therefore withdrawal test is carried out in this study. The withdrawal test shows that steel nail and self-tapping screw work properly to attach each specimen when considering the assembly of wood composite. The observation results indicate different types of fasteners affect the test result significantly. For the fasteners connected with hardwood, the test result shows higher withdrawal resistance than softwood, both using self-tapping screw and steel nail. Based on the test results, there are 3 main failure modes that is concluded, which are fastener failure, material failure, and conditional failure. The test result of self–tapping screw also shows that this kind of fastener is able to withstand 3.5 times stronger than steel nail.

R075-A

Terahertz Techniques of Measurements in Painting Thickness on the Composite Materials

Prof. Kwang-Hee Im, Sun-Kyu Kim, Young-Tae Cho, Yong-Deuck Woo, Jong-An Jung, and David K. Hsu
Woosuk University, Korea

Terahertz waves (T-ray) scanning applications have brought as one of the most promising tool for the nondestructive evaluation. The materials investigated include painting materials on the composites. It is very important to analyze characterization of the non-conducting painting materials on the GFRP (Glass Fiber reinforced plastics) for a use of wind blades. Experimental measurements were made to map out the T-ray signals based on reflection mode. In this research, especially in this characterization procedure, the electromagnetic properties were analyzed such as the refractive index of the paint for a use of wind blades. Data for estimating techniques agree with known solutions. By using these characterized material properties, the characteristics was successfully demonstrated for T-ray behavior propagating through the painting materials for acquiring the refractive index. Also, both C-scan and B-scan images were obtained for analyzing the thickness of painting stratus on the GFRP composites. The Tray technique has been established for the thickness measurement of the painting materials. Good results have been obtained in tests made on the thickness of the standard painted samples with the different thickness ranging from around 30 μm to 440 μm. The method is based on a reflection-mode measurement with using time-of-flight (TOF) and resonance frequencies utilized for acquiring thickness of the painting materials. The thickness deduced from the time domain echo methods and resonance frequency is in good agreement with the results obtained directly from the data of optical microscopes.

R079-A

Photoactivity Enhancement by Natural Convection Control in Hydrothermal Synthesis of Iron Oxide Nanorods

Mr. Heejung Kong, Prof. Junyeob Yeo, Jinjoo Jung, Seunghwi Ahn, Do Hyung Kim and Joonghoe Dho
Kyungpook National University, Republic of Korea

Through this study, we suggest that photoactivity of hematite (α-Fe2O3) nanorods (NR) can be improved by natural convection control. For this, akageneite (β-FeOOH) NR arrays were synthesized on FTO (fluorine tin oxide) -glass substrates by two ways; with/without natural convection control. Then phase transition to hematite could be obtained by annealing and the NR arrays were examined by SEM, XRD, and UV-VIS spectroscopy. In SEM images, it could be confirmed that the amount of unwanted ‘secondary NR’ can be reduced by natural convection control. Although it was difficult to find significant difference except for the amount of secondary NR, there was clear enhancement of photoactivity in the way of natural convection control in its application as a PEC cell. These results imply the way of natural convection control in hydrothermal synthesis is more effective method to fabricate PEC cell using hematite NR, and the detailed analyses are discussed in the conference.

R082-A

Hemispherical Array of Colloidal Crystals Fabricated by Thermal Transfer Printing Method

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Kongju national university, South Korea

Self-assembled colloidal spherical arrays are very attractive materials owing to their potential applications in optics, electronics, photonics, and sensing. In particular, colloidal-crystal monolayers have been studied intensively because of they can be used to produce various

nanostructures and nanopatterns via nanosphere lithography. In this study, we propose a simple way to fabricate a submicron, hemispherical colloidal-crystal monolayer which is very similar to moth-eye structure in nature. Moth-eye structure is well known to have anti-reflective property due to its sub-wavelength periodic structure which gradually changes the refractive index of the surface.
Hemispherical colloidal-crystal monolayer was fabricated by thermal transfer printing method.[1] The experimental process is very simple. First, 3D colloidal crystal was prepared using the vertical deposition method.[2] Then the surface layer of 3D colloidal crystal was picked up using PDMS stamp. By simply heating the target substrate during the releasing step, the adhesion between the substrate and polymeric colloidal particles was reinforced. Consequently, we demonstrated the interlayer-free transfer process on a wide range of substrates, including curved or flexible materials. This heat-mediated process deforms the polymeric colloidal particles from spherical to hemispherical shapes which is a suitable form of lithographic mask for both dry and wet etching process. The aspect ratio and interparticle spacing of the transferred, non-close-packed, hemispherical array could be easily tuned by changing the temperature of the target substrate. As we expected, hemispherical array shows good anti-reflective property. The reflectance of a hemispherical array transferred onto the glass was 4% at 550nm which is much lower than that of bare glass, 9%. This hemispherical structure also was applied as a mask for nanosphere lithography to produce silicon nanopillars and gold dot array. We believe this simple and versatile heat-mediated transfer-printing method can expand the usefulness of colloidal-crystal nanosphere lithography required for not only photonic but also electronic, and bionic applications.

R1009

Influence of Process Parameters of 316LN Hot Wire Filling Laser Welding on the Blunt Edge Layer Forming Quality

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Anhui Technical College of Mechanical and Electrical Engineering, China

Laser welding with hot wire addition is a new type of welding method. In order to search for appropriate laser welding technological parameters, main technological parameters have ran orthogonal optimization tests, root face layers have ran orthogonal experiments, impacts on root face forming qualities of technological parameters have been analyzed. Experimental results show that, the most influential technological parameter of weld width is welding speed, by lowering welding speed heat heat input in per unit of time will be increased, weld width decreases with the increase of defocusing amount and decrease of density of power.

R3018

Numerical Simulation Study of Collision Effect on Damage Evolution in Electromagnetic Forming of Aluminum Alloy

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Wuhan University of Technology, China

A numerical simulation study of collision effect on damage evolution in electromagnetic forming (EMF) was presented. EMF technology can greatly improve the forming limit of metal sheet duo to the high rate. However, collision behavior is also an important factor for the formability of sheet. Free form model and conical die model were carried out to study the effect of collision behavior on mechanical properties of Al alloy sheet. The EMF process of 1050 Al alloy sheet was analyzed and discussed by numerical analysis software LS-DYNA. The combined strategy of boundary element method and finite element method was adopted to realize the coupling calculation of electromagnetic field and structural field. Based on the GTN material model, the evolution and distribution of void volume fraction of 1050 Al sheet were calculated and analyzed. The free forming results were compared with the die forming results,

and the effect of collision behavior on the damage evolution of sheet was obtained. The results showed that the collision behavior can reduce the local (center area) void volume fraction, but excessive collision speed would cause the rebound of the sheet and aggravated the damage of materials. Therefore, the appropriate discharge voltage in this work was found to improve mechanical property of sheet on the premise of forming precision.

EM2004

Design of Alternating Current Abrasive Magnetic Fluid Jet Generator based on Permanent Magnet

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Anhui University Of Science And Technology, China

During the test of DC(direct current) abrasive magnetic fluid technology,many bubbles and noises were generated near the graphite electrode , and the yellow green liquid was produced, which affected the further test.Through the study of graphite electrode, it was found that NaCl solution magnetic fluid produced hydrogen and chlorine gas after electrolysis. At the same time, chlorine gas dissolved in water to form yellow green liquid.The magnetic field of neodymium boron permanent magnet was equivalent to a mechanical stirring, which inhibited the production of chlorine gas.According to the difference of impressed current system, the abrasive magnetic fluid jet technology was divided into DC and AC(alternating current) .There was no electrode in AC abrasive magnetic fluid jet technology, so no gas or noise would be produced.The rotating magic ring permanent magnet produced alternating magnetic field, acting on the abrasive magnetic fluid to form an induced current.Under the action of the magnetic field, the electromagnetic force was applied to move along the circumferential direction to promote the motion of the abrasive magnetic fluid.

EM3004-A

Characteristics of 15-mode Piezoelectric Ceramic-Epoxy Composite

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Kumoh National Institute of Technology, Korea

Magnetoelectric devices possess the characteristic of converting a magnetic field into an electric field, and their applications to various fields such as memory, sensors, actuators, high frequency devices, optical devices, and energy harvesting have been proposed. Many studies have been carried out mainly on the use of magnetostrictive/piezoelectric laminate structures. Most of them have been composed of 31-mode piezoelectric layers, and recently, 33-mode piezoelectric macro fiber composites have been used to increase magnetoelectric sensitivity. It is generally well known that the magnitudes of piezoelectric effect are expressed in the following order: 15-mode > 33-mode > 31-mode. Nevertheless, the applications of 15-mode to magnetostrictive/piezoelectric laminate devices have been rarely found, and the biggest reason is the lack of their proper design and implementation process technology suitable for magnetoelectric effect. For the 15-mode implementation of the piezoelectric layer, the direction of the polarization and the electrode planes must be parallel to each other. If the length of the piezoelectric layer is increased to cm-scale, the poling process in the longitudinal direction becomes very difficult. In this study, we introduce a piezoelectric ceramic-epoxy composite structure that can solve the problem and effectively implement the 15-mode operation at low frequencies. Fundamental characteristics of the composite are presented along with its application to the magnetostrictive/piezoelectric laminates.

R116-A

Microstructures and Reheating Characteristics of Semi-solid AC7A Al Alloy for Thixo-forming

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The aim of this study was to investigate the microstructure and reheating characteristics of semi-solid AC7A aluminum alloys for thixo-forming. Semi-solid Al alloys used in this study were prepared by cooling plate by varying the mold temperature and holding time under a cooling plate angle of 30 degrees and length of 250 mm. For the reheating of semi-solid Al alloys, fabricated alloys are reheated by using an electric resistance heating device. Optical microscopy, scanning electron microscopy and energy dispersive spectrometer were performed to evaluate the microstructural behaviors of the alloys during reheating treatment. The results of this study were shows that semi-solid Al alloy fabricated by cooling plate method were able to form spherical and fine grain shaving the size of 50 micron (or less).And the reheating treatment of semi-solid Al alloy for thixo-forming were proper to set liquid fraction within 10% after reaching target reheating temperature in order to control outflow of liquid metal in semi-solid forming.

R127-A

Phosphorescence Organic Light-Emitting Diodes Using a Graphene Oxide as Hole Injection Layer

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In this paper, we report on fabrication and characterization of green phosphorescence organic light-emitting diode(PHOLED) using a solution-processed graphene oxide(GO)[1][2] as a hole injection layer(HIL). The reference PHOLED device has the structure of ITO/NPB(50nm)/TCTA(10nm)/CBP:Ir(ppy)$_3$(4%)(30nm)/TPBi(10nm)/
Bphen(30nm)/LiF(1nm)/Al(100nm). The solution-processed GO can be a good HIL material[3] because its work function difference with ITO is only 0.2eV. As shown in Fig. 1, solution-processed GO layer(Device 2) and a 5nm thick of HAT-CN layer(Device 3) are tested as a hole injection layer by inserting these layers between ITO and NPB layer in the reference device. In Fig. 2, HAT-CN layer as HIL device shows higher current density than that of GO HIL device, but GO HIL device shows higher current efficiency and higher emission intensity, as shown Fig. 3 and 4, than that of HAT-CN device. This means that GO works as a hole injection control layer which reduces the number of transported holes to emission layer(EML) and improves current efficiency. In this hole excess device structure, GO HIL can improve the charge balance in EML than that of HAT-CN device case.
As a result, GO HIL device reaches the highest current efficiency of 54.8cd/A at 6.5mA/cm^2 which is higher than HAT-CN HIL device. And the peak external quantum efficiency (EQE), 15.94%, is achieved at a current density of 4.77mA/cm^2 and a brightness of 2,600 cd/m^2 and a brightness of over 10,000 cd/m^2 at 13 V. We have found that the solution-processed GO can be used as hole injection layer and show better performance than that of HAT-CN.

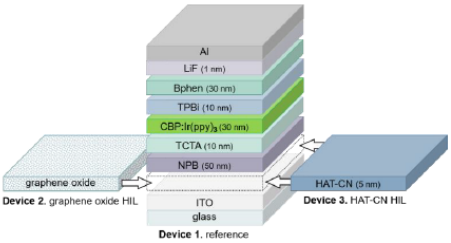

Fig. 1. Device structure

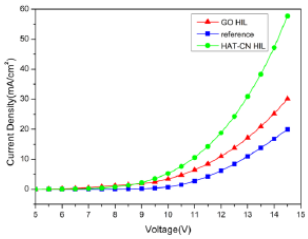

Fig. 2. J-V characteristics

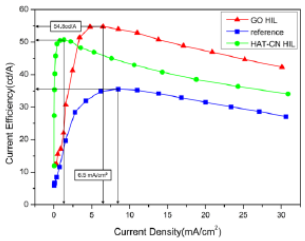

Fig. 3. Current efficiency characteristics

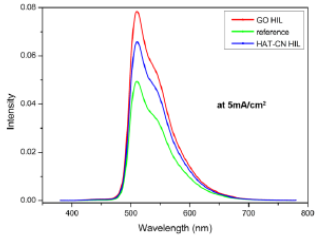

Fig. 4. Emission Spectra

R128-A

Crystal Structure and Microstructure of Metal Carbides in Ni Superalloy

Prof. Jung-Il Lee, Jong Bum Park and Jeong Ho Ryu
Korea National University of Transportation, South Korea

Nickel-based superalloys are important materials for aerospace and power plant applications where high temperature strength and creep resistance are critical. The cast nickel-based superalloy Rene 80 is commonly used to manufacture the first and second stage turbine blades in modern jet engines due to its excellent combination of high stress-rupture strength, thermal fatigue and hot corrosion resistance. Rene 80 is generally used at temperature of 760-982 ℃ and the microstructure of Rene 80 consists of γ matrix, γ' phase precipitates in the γ matrix and the metal carbides. The γ' phase which precipitates during heat treatment is derived from ordered face-centered cubic (FCC) crystal structure (L12) with corners of the unit cell occupied by Al or Ti atoms and face centers occupied by Ni atoms. The script-like and elongated metal carbides can precipitate when the carbon content is too high in the superalloy, which can impair the mechanical properties. Moreover, the script-like and elongated carbides may also cause the fracture modes of superalloy change from the typical intergranular mode to transgranular and intergranular mixed modes. The aim of this work was to provide more information on the microstructure of metal carbide phases in the Rene 80 Ni superalloy prepared by an investment casting, and to evaluate their possible transformation during solidification and cooling in an industrial environment.

R2002-A

A Study of Adhesive properties and FEM Analysis of Multi Materials for Lightweight Center Floor

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Korea Automotive Technology Institute, Korea

Development of lightweight automobile is a substantial alternative measure for the global environmental regulations change. For developing lightweight automobile, the lightweight materials such as magnesium, aluminum and composite have replaced conventional steel in materials and the manufacturing process for lightweight materials are suggested and developed. Especially, research on automotive part using carbon fiber reinforced plastic (CFRP) are ongoing due to its high stiffness. Since it is impossible to weld between materials due to the use of various materials, there is an increasing tendency to use mechanical bonding such as

self-piercing revet (SPR) and blind rivet and bonding using an adhesive.[1] However, it is necessary to study the bonding method between the materials and galvanic corrosion. The finite element method is an effective method of analysis. It is possible to simulate a specimen test and expand it by a component or module unit. In this study, steel (SGAFC780DP 1.2t), aluminum (A7072 T5 2.5t), and carbon fiber reinforced plastic (Plain 1.5t) were used to evaluate the adhesive properties of multi materials and three different methods were used for joining method; adhesive bonding, riveting, hybrid bonding (adhesive bonding + riveting). The adhesive properties [2] were carried out according to the bonding method. The lap shear test was simulated by non-linear finite elements method program which called the Ls-dyna.

R3014

The Electromechanical Behavior of Dielectric Elastomer Actuator Stiffened by Fiber

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Fukuoka Institute of Technology, Japan

Dielectric elastomer is functional material that can convert electrical energy to mechanical energy. Dielectric elastomer(VHB4905) was used to fabricate cylindrical actuator. When the voltage is applied on the actuator, the remarkable strain will appear, and the maximum strain decreases with the rate of applied voltage. In addition, when the fibers are embedded in dielectric elastomer actuator, the performance of the actuators will be promoted observably and anisotropically. In the paper, the effects of fiber-stiffening and rate of applied voltage in the electromechanical tests are clarified.

R096

Effects of Gold nanoparticles on fluorescence polarization and emission spectra of Rhodamine 6G solution

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King Mongkut's Institute of Technology Ladkrabang, Thailand

Fluorescence polarization and emission spectra of Rhodamine 6G solution with gold nanoparticles have been studied. It is found that the emission intensities tend to be low when the gold nanoparticles are added into the solution partly due to the energy transfer from the Rhodamine 6G to gold nanoparticles. The fluorescence polarization increases as the concentration ratio of the gold and Rhodamine 6G is more than 124 and decreases as the ratio is about 1115. The enhancement and reduction of fluorescence polarization values are understood as the shortening of the fluorescence lifetime and a temperature effect from the heating of gold nanoparticles, respectively.

R108-A

Study on Thermal Degradation Behavior of Composites of Liquid Crystalline Epoxy with Silica

Bongsoo Lee, **Assoc. Prof. Seunghyun Cho**
Soongsil University, South Korea

Liquid crystalline thermosetting epoxy, Diglycidyl ether of 4,4-bisphenol (DGEBP) was synthesized and characterized with creoss-polarized optical microscopy (POM) and differential scanning calorimetry (DSC). Silica reinforced DGEBP composites were fabricated by melt blending with a curing agent, sulfanilamide (SAA). To investigate thermal degradation behavior, thermogravimetric analysis (TGA) was performed under nitrogen atmosphere at the temperature range from 30 to 1000℃. Activation energies for decomposition (Ed) by TGA

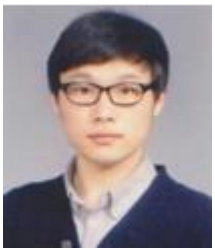
were determined as a function of conversion by weight loss process.

R114-A

Rapid, thermostable antimicrobial peptide-mediated synthesis gold nanoparticles as highly efficient charge trapping medium for sol-gel-derived thin film

Sachin V. Otari, **Mr. Tae-Doo Kim,** Sang-Uk Lee and Jung-Kul Lee
Konkuk University, South Korea

In this study, peptide-mediated synthesis of gold nanoparticles (Ni-GNPs) was conducted via a rapid biological protocol using the thermostable antimicrobial peptide nisin. Gold ions in the reaction mixture were mixed with nisin peptides and autoclaved to form colloidal Ni-GNPs. Characterization analysis revealed that the UV–vis spectra of the GNPs showed a peak at 530 nm. X-ray diffraction and X-ray photoelectron spectroscopy of the Ni-GNPs confirmed their crystalline nature. Scanning electron images of the Ni-GNPs showed that they were spherical in shape and were uniform in size. Transmission electron microscopy analysis revealed the presence of peptides on the surface of spherical GNPs. The attachment of GNPs to the particles was demonstrated using circular dichroism. Ni-GNPs showed the presence of intact antimicrobial peptides on the surface of nanoparticles. The obtained Ni-GNPs were embedded as a charge storage medium in an insulator and ZnO semiconductor interface based on sol-gel-derived solution of processed thin film transistors. The fabricated device clearly exhibited hysteresis characteristics, suggesting that charge trapping occurred via the GNPs.



R099-A

A Study on the Strength Properties of Cement Mortar Containing Cellulose Nanocrystals and Cellulose Nanofibrils

Mr. Hyungjoo Lee, Mr. Seungki Kim, Mr. Junho Kim, Assistant Prof. Woosuk Kim
Department of Architectural Engineering, Kumoh National Institute of Technology, South Korea

This study was conducted to investigate the strength of cellulose nano -crystals(CNCs) and cellulose nano-fibrils(CNFs) with 0.1% and 0.2% of the cement volume fraction in accordance with proper dispersion. The purpose of this study is to present fundamental data on the effect of nanomaterials on cement strength. as a part of the study to apply nanomaterials to cement.

R071

Fabrication of lightweight concrete composites using natural fibers in Thailand

Dr. Pat Sooksaen, Vimon Boodpha, Porntipa Janrawang and Peemmawat Songkasupa
Silpakorn University, Thailand

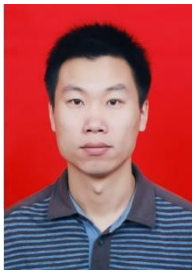
This study developed lightweight concretes by using three different natural fibers from agricultural industries in Thailand which were corn husk fiber, bagasse fiber and coconut husk fiber. Low cost lightweight concretes in this study were fabricated using Ordinary Portland Cement type-1, coal fly ash, un-treated natural fibers and NaOH-treated natural fibers. The specimens were tested for bulk density, compressive strength, microstructure and deterioration. The result showed that the strongest concrete composite was obtained using 30 vol% fine coconut husk fiber in the concrete mixture. The treated fibers showed an improvement in surface adhesion between cement matrix and fibers which resulted in higher compressive strength value.

B022

Conversational Bricks and The Future of Architecture: Will <Stores> Survive as the Epicenter for <Retail> Activity in Society?

Brian Subirana, **Ms. Nava Haghighi**, Dick Cantwell, Sanjay Sarma
Massachusetts Institute of Technology, USA

The most advanced IoT technologies enable giving physical objects human-like personalities and allowing humans to “converse” with them in any environment. In this paper, we explore the disruptive potential of adding conversational capabilities to any construction material such as bricks and in particular, explore retail and conversational commerce with the aim of designing physical spaces that can compete with e-commerce. We define conversational architecture as the design of buildings enabling human engagement with objects, physical environments, and virtual entities using conversational speech. In a time where digital content and virtual spaces are becoming more relevant through personalization and anticipation of needs, conversational commerce technologies can create a seamless experience between the digital and the physical, making both experiences more rich, while helping bring the relevance of digital experience to physical. In this paper, we will discuss open areas of research in conversational architecture through examining the enabling technologies and open problems that need to be addressed. We contend Conversational Architecture is a building technology that may ensure long-term sustainability of collective architecture and hope to accelerate research and policy discussions in this new and emerging field



B004

Wind-induced vibration response analysis of FRP bracket-line coupling system

Mr. Xin Gu, Jiayu Zhao, Yiliang Peng and Qing Sun
Henan Electric Power Survey & Design Institute, China

According to the basic properties of fluctuating wind, Simiu spectrum and linear autoregressive filter method，a program of Simiu spectrum-time curve has been compiled in the Matlab. The time history of fluctuating wind velocity for a few points has been simulation based on Simiu spectrum. The results show that the method is feasible. Taking the FRP bracket-line coupling system as an example, the wind-induced vibration response of the structure at different angles of windand at different wind speeds is analyzed by using the finite element software ANSYS. The results show that the wind in the 90 degree direction is the most unfavorable wind direction for the whole structure according to the three kinds of angle wind calculated at

present and when the 0 degree wind acts on the structure, wires have a certain damping effect in the bracket-line coupling system. By comparing and analyzing the influence of different wind speeds and different wind attack angles, it is found thatin the bracket-line coupling system, the bracket structure is more sensitive to the increase of wind speed while the conductorsare more sensitive to the change of wind attack angle.

B005

Research on the connection property of bonded steel sleeve connection for full-scale composite member

Mr. Hongbo Li, Panpan Cao, Yiliang Peng and Qing Sun
Henan Electric Power Survey & Design Institute, China

In this paper, extrusion experiment of the connection property between full-scale composite member and steel sleeve has been conducted. Based on the test of the designed specimens, the failure process and failure characteristics were observed, the load-displacement curves and strain distribution of the specimens were obtained. The finite element model of ANSYS was set up to simulate the failure of the component under axial compressive force. The simulation results were compared with the experiment to verify the correctness of the finite element model. Then the tensile connection strength of the component was obtained with the same model. The connection performance of the component was analyzed to provide the basis for engineering application of bonded steel sleeve connection for composite member.

B013-A

Experimental Study on Condition of Early Age Concrete Member with Nondestructive Tests Technique

Mr. Chang-Jong Lee, Seonguk Hong, Jong-Hyun Kim, Seunghun Kim, Yongtaeg Lee
Kumsung Baekjoe Const. co., LTD; Department of Architectural Engineering, Hanyang University

Since interest of periodic inspection for maintenance and a diagnostic workup which can evaluate the damage on structures caused by aging and natural disaster is increased, development of non-destructive inspection methods is inevitable. In order to perform fast and precise inspection on structures, multi-physics non-destructive inspection technology using pros of stress wave based non-destructive inspection methods. In the September of 2016, a parking tower in Tel Aviv, Israel in a construction collapsed and made casualties. This construction field also had an accident of concrete beam collapsing. In
the August of 2016, a building collapsing during remodeling construction in Jinju, South Korea. Accidents with casualties are being made by imprecise evaluation of compressive strength of early aged concrete.
When evaluation status of a concrete structure, not only evaluation at maintenance, but estimation of compressive strength by various methods in middle of construction is required. Therefore, non-destructive inspection methods which can figure out the status of a structure without damaging it is rising.
The goal of this study(NRF-2017R1A2B2009743) is to estimate early aged concrete compressive strength using ultrasonic pulse velocity method which is one of non-destructive inspection methods. Experiments about estimation of compressive strength of early aged concretes on 75 test subjects which are made based on designed strength of 24, 30, 40 MPa, and aging of 16, 20, 24, 72, 120 hours. The relation between ultrasonic pulse velocity and compressive strength is observed so that estimation of compressive strength of early aged concrete is possible at construction fields. Moreover, utility of non-destructive inspection methods as a quality control method for concrete structure is observed.

B024-A

Ultimate Strength Comparison of Base Metal Fracture in Welded Connection with Duplex Stainless Steel with Low Nickel

Bokyung Hwang, Yeongmin Hwang, Hyunsik Kang, **Prof. Taesoo Kim**
Hanbat National University, Korea

The utilization of duplex (austenitic and ferritic) stainless steel which has lower nickel component and excellent corrosion resistance compared with austenitic stainless steel is expected to be increased in building structures. Recently, lean duplex stainless steel, STS329FLD with less nickel (reduced to 0.5~1.0% in KS) has been developed as a substitute of austenitic stainless steel. However, there is no enough data to estimate the ultimate strength of welded connection. Therefore, in this paper (supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (KRF-2015R1D1A3A01016603)), monotonic tensile test was performed to investigate the structural behaviors of STS329FLD stainless steel fillet welded connection with base metal fracture. All specimens showed a block shear fracture (combination of tensile fracture and shear yielding or fracture) in base metal not weld metal. Ultimate strengths got larger with the increase of weld lengths. Test ultimate strengths were compared with those by KBC2016, AISC standards and equations suggested by other researchers (Topkaya and Oosterhof et al.). As a result, design equations tended to underestimate the strengths of duplex welded connections.

B023-A

An Estimation of Compressive Strength of Concrete Depending on Steel Fiber Volume Fractions with Non-destructive Tests Method

Seong-Uk Hong**, Prof. Seunghun Kim**
Hanbat National University, South Korea

In this experimental program(Research fund of Hanbat National University in 2017: No. 201702810001), an ultrasonic pulse velocity method, a non-destructive testing technique, was applied to draw a correlation with which a compression strength of concrete, which is one of the concrete quality control parameters, can be estimated depending on volume fractions of steel fiber. Two variables on the fiber volume fraction were set up to be 0% and 1%, and nine stages of the curing time were set up to be 16, 20, 24, 48, 72, 216, 360, 504, and 672 hours, thus producing 135 cylinder specimens in total. The experiment drew a correlation that as the fiber volume fraction increases from 0% to 1%, the compression strength of concrete becomes higher by 18.6% on average in each of the stages, and as the compression strength becomes higher, the ultrasonic pulse velocity increases. Therefore, the ultrasonic pulse velocity method was found to be an effective quality management technique for steel fiber reinforced concrete.

B3003

Application of Redundancy to Steel Box Tied Arch Bridge Structural System

Mr. Xiaobo Zheng, Chung C. Fu, Shuanhai He, Dalin Hu
Chang' an University, China

Bridge redundancy is defined as the ability of a bridge system to continue to carry load after the failure of one or several structural components. A bridge will collapse progressively after the failure in some main components, if the bridge is in short of redundancy. The system factors for redundancy have been investigated in the design of the bridges with simple systems. However, there is no corresponding redundancy criteria established for the bridges with long span and

complicated structural systems. This paper studied the superstructure of a through steel box tied arch bridge. The member failure, ultimate limit state and functionality limit state were analyzed with ‘Step-by-Step’ procedure. Thus, the most fragile component and weakest damaged systems are determined. It is concluded that this through steel box tied arch bridge has enough level of redundancy. This finding could be a reference for the design and maintenance for bridges with similar structural systems

B014

Analysis of Energy Consumption by Geothermal Heating and Cooling Systems and Building Integrated Photovoltaic Systems (BIPV) for College Building

Kim Kang-Min, **Prof. Lee Kang-Guk**, Hong Won-Hwa
Kyungpook National University, Korea

With the recent amendment of the Act on the Promotion of the Development, Use and Diffusion of New and Renewable Energy, new buildings to be built as part of the new and renewable energy equipment obligatory installation project, including school building are required to install new and renewable energy systems. However, the lack of installation guidelines and the absence of efficient installation strategies with minimized energy and operation costs with the unique characteristics of school facilities taken into account leave much to be desired in implementing this project. Against this backdrop, this study aims to estimate the energy load of the Energy Consumption by Geothermal Heating and Cooling Systems and Building Integrated Photovoltaic Systems (BIPV) dedicated to college buildings and to analyze their economic feasibility in order to present basic information to save energy of college buildings along with ways to revitalize the use of new and renewable energy.

Date: 20 Jan. 2018(Saturday)

Time: 16:55-17:35

Venue: Coffee Break Area

Time	
16:55-17:35	**Session P-2: *Chemical and Biological Engineering***

Note:

* The certification of Poster presentations, will be awarded at the end of each session.
* Best Presentation of each session is encouraged to award to student author prior.
* Winner of Best presentation will be announced at the end of each session and awarded winner certificate over the banquet on Jan. 20.
* To show respect to other authors, especially to encourage the student authors, we strongly suggest you attend the whole session.
* Session photo will be taken at the end of each session and updated online.

No.	Paper ID	Title
35	**R100-A**	Synthesis of Environment Friendly Saccharide Biosurfactants Based on Vegetable Oils and Characterization of Interfacial Properties for Cosmetic and Household Products Formulations
36	**R1008-A**	Study on the adsoption kinetics and thermodynamics of NO3-N on Si-Al porous material
37	**R3017-A**	Synthesis of polyurethane foam using ultrasonically treated PU
38	**R017**	Experiments on Microalgae Mud Adsorbing Heavy Metal Pb(II) Ions and Study on its Thermodynamics
39	**EM006-A**	Preparation of gel polymer electrolyte (GPE)/non-woven separator by curing of multi-component epoxy resins
40	**EM2001-A**	Influence of variously MCM-41 & SBA-15 fillers of PBI composite membranes for high temperature polymer fuel cells
41	**EM2003**	Tensile mechanical properties properties of HTPB propellant at low temperature
42	**EM2006-A**	Transition-metal chalcogenide electrode deposited on soft substrate for sodium ion batteries
43	**EM2007-A**	Electrodeposited lithium layer as a anode for lithium metal batteries
44	**EM2008-A**	MoS2 nanosheets decorated with gold nanoparticles for a supercapacitor electrode
45	**EM3003-A**	Characteristics of sol-gel ZnO layer in organic solar cell according to humidity
46	**EM3006-A**	Electrochemical characteristics of SnTe-based anodes for Li- and Na-ion batteries
47	**R067-A**	Synthesis and antibacterial activity of silver nanoparticles confined mesoporous structured bioactive glass powder
48	**R3015-A**	Assessment of Peanut Allergen Ara h1 in Processed Foods Using a SWCNTs-based Nanobiosensor
49	**R109-A**	Structure-optimized novel SiO2 microparticles as an efficient support for enzyme immobilization and their application in biosensor development
50	**R110-A**	Immobilization of xylanase using a protein-inorganic hybrid system
51	**R111-A**	Fe2O3 yolk-shell particle-based laccase biosensor for efficient detection of

		2,6-dimethoxyphenol
52	**R113-A**	SnO2 hollow nanotubes: a novel and efficient support matrix for enzyme immobilization
53	**R102**	Release of Sodium Salicylate from Hydrogels Prepared from Wheat and Arrowroot Starches
54	**R073**	Experimental investigation on aerosol-particle sustaining characteristics of a porous-walled tube
55	**EM3007**	Strength and Durability of High Performance Concrete Doped New Low Clinker Cementing Material
56	**EM3008-A**	Three-dimensional Array of Bi2S3 Nanorods Grown on Carbon Textiles as a Cathode for Flexible Lithium-Oxygen Battery
57	**EM3010-A**	Preparation of Two-dimensional Bismuth Sulfide Composite Foam Nickel Cathode Material as Li-O2 Battery High Efficient Catalyst
58	**EM3011-A**	New Metal-Organic Frameworks based on 2,3-Pyridinedicarboxylic Acid for White LED
59	**EM3012-A**	Synthesis and Photoluminescence Enhancement of Ca3Sr3(VO4)4:Eu3+ red Phosphors by Sm3+ doping for White LEDs

16:55–17:35, Saturday, 20 Jan.

Session P–2: Chemical and Biological Engineering

Venue: ***Coffee Break Area***

Chair:

R100-A

Synthesis of Environment Friendly Saccharide Biosurfactants Based on Vegetable Oils and Characterization of Interfacial Properties for Cosmetic and Household Products Formulations

Soomin Lee and **Prof. Jongchoo Lim**
Dept. of Chemical and Biochemical Eng, Dongguk University, Korea

In this study, 2 types of nonionic saccharide biosurfactants GP-6 and GP-7 were prepared from vegetable oils. The structure of the resulting saccharide biosurfactants was elucidated by FT-IR, 1H NMR, and 13C NMR spectroscopies and their interfacial properties have been examined such as CMC, static and dynamic surface tensions, interfacial tension, wetting property, emulsion stability, and foam property. Biodegradability test, acute toxicity test, and irritation test have also been performed for their environmental compatibility.

R1008-A

Study on the adsoption kinetics and thermodynamics of NO3-N on Si-Al porous material

Ms. Liping Jia, Binhui Jiang and Xiaomin Hu
Northeastern Universit, China

There was a large number of NO_3-N in most of China's urban contaminated surface water and groundwater and tail water of wastewater treatment plant. NO_3-N wastewater was difficult to undergo biological denitrification due to lack of carbon source, therefore, this study applied physical method to deal with NO_3-N wastewater, using a laboratory synthetic Si-Al porous material handling NO_3-N wastewater, to study the adsorption kinetics and thermodynamics of NO_3-N on it. The porous materials include quartz, mullite and rutile, its chemical components were 56.78 wt%SiO_2, 37.11 wt%Al_2O_3, 1.58 wt%Fe_2O_3, 2.78 wt%K_2O and 1.75 wt%impurities. Its pore size was 30-1000μm, the porosity was 30-90% and the particle size was 5-10mm. The adsorption of NO_3-N on the Si-Al porous material was carried out by Langmuir, Freundlich and Henry isothermal adsorption models, the results shown in Fig. 1, the relevant parameters as shown in Table 1. Three kinds of isothermal adsorption models were suitable for the adsorption of NO_3-N on the Si-Al porous material and the best was the Freundlich isothermal adsorption model. As Si-Al porous material was microporous material, NO_3-N wastewater filled in the channel, and the outer surface area was much smaller than the internal surface area, therefore adsorption capacity was controlled by the pore volume. In Figure 1, there was no turning point of the curve indicates meant Si-Al porous material was not fully filled with NO_3-N wastewater, had a greater adsorption capacity. By adsorption kinetics test, the adsorption kinetics curve was fitted with pseudo-first order and pseudo-second order model, respectively, as shown in Fig. 2, and the related parameters were shown in Table 2. Fig. 2 and Table 2 showed the pseudo-first order and pseudo-second order model could describe the dynamic process accurately. By comparing the correlation coefficient R^2 and the difference between the equilibrium adsorption amount test value Q_e(exp) and the calculated value Q_e (cal) in the fitting result, it was found that the adsorption kinetics of NO_3-N on silica-alumina porous

materials was more suitable for pseudo-first-order kinetics model. When the initial concentration of NO_3-N in the adsorption system increased from 5mg/L to 25mg/L, the adsorption rate increased from 1.5×10^{-2} mg/(g h) to 2.6×10^{-2} mg/(g h), and then decreased to 1.7×10^{-2}mg/(g h). It could be seen that the increase of NO_3-N concentration in the solution had different effects on the adsorption rate of NO_3-N on Si-Al porous materials. The adsorption rate increased first and then decreased with the increase of the initial concentration, the adsorption rate reached the maximum when the initial concentration was 20 mg/L.

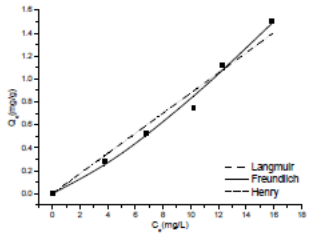
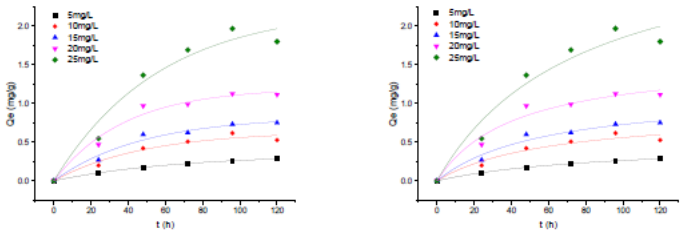


Fig.1 Isothermal adsprption tests of NO_3-N on Si-Al porous material

Adsorption isotherm models	Related parameters		
Langmuir	Q_m	K_L	R^2
	3080.711	2.85E-05	0.94193
Freundlich	K_F	n	R^2
	0.04423	0.786671	0.98008
Henry	K_H		R^2
	0.08772		0.95652



(a) Pseudo-first order model (b) Pseudo-second order kinetic model

Fig.2 Sorption kinetics tests of NO_3-N on Si-Al porous material at various initial concentrations

Table 2 Kinetic fitting parameters for pseudo-first order and pseudo-second order model of NO_3-N on Si-Al porous material at various initial concentrations

C_0/mg·L^{-1}	Pseudo-first order model				Pseudo second order kinetic model			
	Q_e(exp)/ mg·g^{-1}	Q_e(cal)/ mg·g^{-1}	k×10^2/h^{-1}	R^2	Q_e(exp)/ mg·g^{-1}	Q_e(cal)/ mg·g^{-1}	k×10^2/h^{-1}	R^2
5	0.27	0.34	1.5	0.9984	0.27	050	2.2	0.9984
10	0.58	0.64	2.1	0.9502	0.58	0.90	1.8	0.9386
15	0.74	0.83	2.1	0.9728	0.74	1.15	1.5	0.9669
10	1.11	1.20	2.6	0.9717	1.11	1.58	1.5	0.9618
25	1.79	2.24	1.7	0.9539	1.79	3.29	0.4	0.9441

R3017-A

Synthesis of polyurethane foam using ultrasonically treated PU

Mr. Junho Moon, Sung Bok Kwak, Jae Yong Lee, Doyoung Kim, and Jeong Seok Oh
Gyeongsang university, South Korea

This study deals with the recycling of flexible polyurethane (PU) foam by the application of continuous process using ultrasonic reactor. Different screw speed(20rpm, 40rpm) were subjected to ultrasonic irradiation at different amplitude(5um, 10um, 15um) to investigate

the effect of different operating condition on the intensity of irradiation. Ultrasonically treated PU was decrosslinked and then was used as the polyol and isocyanate replacement at each ratio (5wt%, 10wt%, 15wt%). Flexible PU foam was prepared using toluene diisocyanate (TDI) and polyol mixture with treated PU. Gel fraction and crosslink density of treated PU were analyzed. Mechanical, thermal, and morphological properties were measured. The results showed that ultrasonically treated PU is decrosslinked successfully and then the recycled PU foams with treated PU are resilient and soft compared to the virgin PU foam. The supporting behavior for seat was improved.

R017

Experiments on Microalgae Mud Adsorbing Heavy Metal Pb(II) Ions and Study on its Thermodynamics

Prof. Binhui Jiang, Guangtai Zheng, Jiaqi Zhang, Shuqi Yang
Northeastern Universit, China

In this paper, the microalgae mud (MAM) was used as the raw material produced by the high efficiency algae pond. The factors such as the amount of microalgae addition, time of shock, temperature, the concentration of lead, and the shaker speed were studied by single factor control variables. The results showed that when the initial concentration of Pb (Ⅱ) was 30mg/L, the amount of MAM was 30g/L, the shaker speed was 180rpm and the oscillation was adsorbed at pH 4, 25℃ in a constant temperature oscillator. After 30 min reaction, the maximum adsorption rate of heavy metal Pb (Ⅱ) by MAM was 81.14 %. When the pH was 4, the adsorptions of 30 min and above was the best, the adsorption process was in accordance with the Langmuir and Freundlich adsorption isothermal model. The correlation coefficient R2 of Langmuir and Freundlich both were greater than 95%.

EM006-A

Preparation of Gel Polymer Electrolyte (GPE)/Non-Woven Separator by Curing of Multi-Component Epoxy Resins

Wei You, **Prof. Kuo-Chung Cheng**, Jian-Yu Chen
National Taipei University of Technology, Taiwan

Gel polymer electrolyte (GPE)/non-woven separators were prepared by
impregnation of different epoxy resins with curing agent: DMP-30, into the nonwoven PP. A lithium-ionic liquid electrolyte was further absorbed into the composite separators formed by the nonwoven PP and epoxy thermoset. The thermal shrinkage, electrolyte uptake, ionic conductivity, thermal and mechanical properties dependent on the composition of the different epoxy resins and solvent were analyzed and discussed. It was found that the thermal shrinkage tested at 160oC for 4 hours of the separator could be decreased to 5 % from 20 % of the nonwoven PP. The ionic conductivity of the separator was dependent on the electrolyte uptake and the chemical structure. For example, the ionic conductivity could reach 1.3×10−3 Scm−1 at 70oC when the separator modified with the mixture of epoxy resins.

EM2001-A

Influence of variously MCM-41 & SBA-15 Fillers of PBI Composite Membranes for High Temperature Polymer Fuel Cells

Mr. Ying-Chieh Kuo and Hsiu-Li Lin
Yuan Ze University, Taiwan

In this study, we elucidated the effects of the addition of various mesoporous silicates (0–20

wt%) to the membranes used for high-temperature polymer fuel cells (HT-PEMFCs) on cell performance. Two types of PBI-based hybrid membranes were prepared by homogeneously dispersing a predetermined amount of the silica MCM-41 (pore diameter of 4.56 nm and particle size of 80–140 nm) or SBA-15 (pore diameter of 10.22 nm and particle size of 420–650 nm) within the PBI matrix. Further, with an increase in the MCM-41 and SBA-15 contents of the hybrid membranes, the PA doping amount also increased, owing to an increase in the number of hydrogen bonds between the PA molecules and the -OH group of the filler particles; this further improved cell performance. The SiO2 nanoparticles in the PBI/MCM-41 and PBI/SBA-15 films could retain a greater number of acid molecules through the -OH group, thereby preventing acid leakage from the membranes. Compared to the pure PBI membrane, those with MCM-41 and SBA-15 exhibited significantly enhanced phosphoric acid doping and better mechanical properties, leading to improved HT-PEMFC performance and reduced acid migration. Finally, during performance test, the PBI/MCM-41 (10 wt%) membrane showed the best performance (maximum power density of 375 mW cm-2).

EM2003

Tensile Mechanical Properties Properties of HTPB Propellant at Low Temperature

Dr. Xiangdong Chen, Xin-long Chang, Youhong Zhang, Bin Wang, Qing Zhang, Xiang Zhang
Xi'an High-tech Institute, China

To study the low temperature effects of tensile mechanical properties on Hydroxyl-terminated polybutadiene (HTPB) propellant, a quasi-static mechanical experiment was conducted. The results show that tensile mechanical parameters are closely related to strain rate and low temperature. With the decrease of temperature and increase of strain rate, the modulus and tensile strength of HTPB propellant increase obviously. Based on the time-temperature equivalence principle (TTEP), the master curves of tensile strength and initial modulus for HTPB propellant were obtained, which can facilitate the structural integrity analysis of the propellant. The damage of propellant is matrix tearing and dewetting between the filled particles and matrix.

EM2006-A

Transition-metal Chalcogenide Electrode Deposited on Soft Substrate for Sodium Ion Batteries

Mr. Tae Kyong Yoo and Chan-Hwa Chung, School of Chemical Engineering, Sungkyunkwan University, Suwon 16419, Republic of Korea
School of Chemical Engineering, Sungkyunkwan University, Republic of Korea

Sodium ion batteries (SIBs) are regarded as one of the candidates for promising energy storage system, which can replace the lithium batteries (LIBs) because of the abundance of sodium source compared to lithium. Since the basic intercalation mechanism on the electrode of both systems are very similar, the application of the same anode materials of LIBs into SIBs were tested. However, the obvious difference in the size of Na+ (1.02 Å) from that of Li+ (0.76 Å) brought problems in the ion intercalation on the anode and thus the necessity of new electrode materials has arisen. Transition metal chalcogenides have gathered great attention among researchers for their electrochemical characteristics and multi-layered structures which shows high ion capacity. Specifically, tungsten disulfide (WS2) has interlayer distance of 0.62 nm, which is almost double of graphite, and thus it presents a great potential to be utilized as the anode materials of SIBs. Still, the short cycle stability due to pulverization of WS2 when Na+ ions are intercalated remains to be a major challenge. In this work, an anode in SIBs consisting of a WS2 film deposited on a soft substrate will be presented. The cell stability showed great improvement compared to

former works. The soft substrate acts as a buffer by releasing the mechanical stress applied on the WS2 film during sodiation process and therefore prevents the pulverization. The morphology change of WS2 layer according to sodiation was observed through field emission scanning electron microscope (FE-SEM), X-ray diffraction (XRD) and the stiffness of the substrate was analyzed using nanoindentor. It suggests new insight on using transition metal chalcogenides as electrode materials of SIBs.

EM2007-A

Electrodeposited Lithium Layer as a Anode for Lithium Metal Batteries

Mr. Jinhoon Yang, Bitna Choi and Chan-Hwa Chung
School of Chemical Engineering, Sungkyunkwan University, Republic of Korea

Recently, the electric vehicle market has begun to attract attention and requires energy storage devices with high energy density and eco-friendly. Accordingly, metallic lithium is an ideal anode material has the theoretical capacity (3,860 mAhg-1), the lowest standard reduction potential (-3.040 V vs the standard hydrogen electrode) and low density (0.59 gcm-3). But the metallic lithium grows in dendric structures on the lithium surface during charge-discharge cycles. Li dendrite induces big problems in stability, safety risks and low coulombic efficiency (CE). Here, we have prepared dense lithium layer on copper foil using electro-deposition method to prevent the dendritic growth of lithium during charge-discharge cycles. The electrodeposited lithium layer on copper maintains relatively uniform surface morphology compared with commercial lithium foil after charge-discharge cycles. The morphology and chemical state of lithium layer on copper are characterized by field-emission scanning electron microscopy (FE-SEM) and X-ray photo electron spectroscopy (XPS). The electrochemical performance and the stability of the electrodeposited lithium layer as a anode for the lithium metal batteries are evaluated by gavanostatic charge-discharge (GCD) and Electrochemical impedance spectroscopy (EIS).

EM2008-A

MoS2 Nanosheets Decorated with Gold Nanoparticles for a Supercapacitor Electrode

Mr. Dulyawat Doonyapisut, Padmanathan Karthick Kannan, Bit Na Choi and Chan-Hwa Chung
School of Chemical Engineering, Sungkyunkwan University, Republic of Korea

Recently, MoS2 has been widely used for energy storage application. The noble metal such as silver is used to improve the electron mobility in MoS2 with the maximal specific capacitance of 980 F/g [1]. In this work, a simple and facile procedure for the preparation of gold nanoparticle decorated semiconducting phase (2H) MoS2 nano sheets and metallic phase (1T) MoS2 nano sheets is presented. For the synthesis of two different phases of MoS2 nanosheets, hydrothermal method is employed. To prepare nano gold decorated MoS2 nanosheets, the as-prepared MoS2 was mixed with AuCl3 solution. Using this method, gold nanoparticles with size of 50 nm are obtained. It is found that MoS2 nanosheets decorated with gold nanoparticles exhibits good EDLC behavior, with the typical rectangular shape cyclic voltammetry curve and 82 ° phase angle observed from electrochemical impedance spectroscopy at low frequency region. From the experimental results, it is clear that gold nanoparticles decorated MoS2 nanosheets have a potential to play a role as an efficient electrode material for supercapacitor application.

EM3003-A

Characteristics of Sol-Gel ZnO layer in Organic Solar Cell According to Humidity

Hyojin Song, **Ms. Sang-Hye Lee**, Hyo-Chang Kim, Won-Pyo Jang and Jongbok kim
Kumoh National Institute of Technology, Korea

organic solar cells can be made light and flexible, and they are being actively studied for their cost advantages through the roll-to-roll process. However, low efficiency due to stability and lifetime is still making commercialization difficult. One of the methods for increasing the efficiency is to introduce a buffer layer between the light absorbing layer and the electrode to activate charge transfer. ZnO, which has high electron mobility, good hole blocking ability and environmental stability, is used as an electron transport layer. Among the various methods of forming such ZnO films, the sol-gel process is widely used because it has a merit of simple solution process and low temperature process. The sol-gel process is based on the hydrolysis reaction and is greatly influenced by the external environment. The difference in hydrolysis rate due to humidity and the shape and properties of the resulting film were studied. Therefore, in this study, we measured the mobility of electrons to examine the charge transfer ability after forming the ZnO film by controlling the humidity, and investigated the characteristics of the film according to the humidity by irradiating the surface shape through the AFM. We also applied it to the device and confirmed the effect on the actual device.

EM3006-A

Electrochemical Characteristics of SnTe-based Anodes for Li- and Na-ion batteries

Cheol-Min Park, **Mr. Sang-Min Lee**, Suk-Hwan Kim and Jae-Seung Roh
Kumoh National Institute of Technology, Korea

A cubic crystal-structured SnTe was synthesized using a solid-state synthetic process to produce a better rechargeable battery, and its possible application as a high-capacity anode material for Li-ion batteries (LIBs) and Na-ion batteries (NIBs) was investigated. The electrochemical reaction mechanisms of the SnTe electrodes during Li and Na insertion/extraction were thoroughly examined utilizing various ex situ analytical techniques. During Li insertion, SnTe was converted to Li4.25Sn and Li2Te; meanwhile, during Na insertion, SnTe experienced a sequential topotactic transition to NaxSnTe ($x < 1.5$) and conversion to Na3.75Sn and Na2Te, which recombined into the original SnTe phase after full Li and Na extraction. The distinctive electrochemical reaction mechanisms provided remarkable electrochemical Li- and Na-ion storage performances, such as large reversible capacities with high Coulombic efficiencies and stable cyclabilities with fast C-rate characteristics, by preparing amorphous-C-decorated nanostructured SnTe-based composites.

R067-A

Synthesis and Antibacterial Activity of Silver Nanoparticles Confined Mesoporous Structured Bioactive Glass Powder

Prof. Chi-Jen Shih
Department of Fragrance and Cosmetic Science, College of Pharmacy, Kaohsiung Medical University, Taiwan

Many clinical cases show that the failure of root-canal treatment is primarily attributable to remnants of bacteria in root canal systems, especially *E. faecalis*.
In this study, silver nanoparticles confined mesoporous structured bioactive glass powder

BG-M, BG-M-Ag1, BG-M-Ag5 and BG-M-Ag10 were prepared and evaluated for antibacterial activity against *E. faecalis*. X-ray diffraction (XRD), gas adsorption and desorption analyzer, and transmission electron microscopy (TEM) were used to characterize these powders.
From XRD patterns and selected area electron diffraction (SAED) patterns, we observed that the crystalline phases generated in these powders were silver and silver oxide, which were consistent with JCPD 87-0597and JCPD 72-2108, respectively. All of the test samples had similar mesopore sizes of 6.5 to 6.9 nm. The test samples' surface area decreased with increasing Ag ratio. The surface areas of the BG-M, BG-M-Ag1, BG-M-Ag5 and BG-M-Ag10 test samples were 308 m2/g, 298.9 m2/g, 254 m2/g, and 200.6 m2/g, respectively. The TEM images showed two different morphologies. For the BG-M-Ag1 test sample, the silver nanoparticles were confined to the mesoporous structured BG-M matrix at approximately 2-5 nm. Nevertheless, for the BG-M-Ag10 test sample, the silver nanoparticles were attached on the surface of the BG-M matrix at more than 50 nm.
The antibacterial activity of the test samples against *E. faecalis* was verified by the time-killing curve test and the colony-forming capacity assay. The samples' antibacterial activities depended on the confined silver nanoparticles position. When the silver nanoparticles were confined to the inside of mesopores, the samples had good antibacterial activity against *E. faecalis* infection in root canal systems. The minimum inhibitory concentrations (MIC) of the test samples against *E. faecalis* were between 2.5 mg/mL and 5 mg/mL. The minimum bactericidal concentrations (MBC) of the test samples against *E. faecalis* were between 10 mg/mL and 20 mg/mL.

R3015-A

Assessment of Peanut Allergen Ara h1 in Processed Foods Using a SWCNTs-based Nanobiosensor

Abdus Sobhan, Jun-Hyun Oh, **Assist. Prof. Jinyoung Lee**
Sangmyung University, South Korea

The peanut protein Ara h1 is one of the most serious food allergens that contribute to food-related life-threatening problems worldwide. Because of the extremely low allergic dose, this demands an accurate, rapid, and highly sensitive assay that can assess potential allergen biomolecules in foods. In this study, a single walled carbon nanotube (SWCNT)-based nanobiosensor was used for the detection of Ara h1. The nanobiosensor was based upon the binding of Ara h1 to an anti-Ara h1 polyclonal antibody (pAb) and a 1-pyrenibutanoic acid succinimidyl ester (1-PBASE) as linker to the SWCNT that connected gold electrodes embedded in the biosensor silicon. Resistance values increased as the concentration of Ara h1 increased over the range of 1 to 10^5 ng/L. A specificity analysis demonstrated that the anti-Ara h1 pAb selectively interacted with Ara h1 molecules in phosphate buffered saline (PBS) solution. The biosensor was exposed to extracts prepared from processed food containing peanuts, or no peanuts, and could successfully distinguish the peanut containing food. Transmission electron microscopy (TEM) revealed the nanostructure of assembled SWCNTs and atomic force microscopy (AFM) was used to analyze the morphology of the biosensor.

R109-A

Structure-optimized Novel SiO2 Microparticles as an efficient Support for enzyme Immobilization and Their Application in Biosensor Development

Ashok Kumar, **Mr. Tae-Doo Kim**, Sang-Uk Lee and Jung-Kul Lee
Konkuk University, South Korea

Novel mesoporous SiO_2 microparticles were synthesized by spray pyrolysis using multiwalled carbon nanotubes (CNTs) as a template. The synthesized multicompartment

structure with uniform pores of 12.0 nm was used to immobilize enzymes, including horseradish peroxidase (HRP), glucose oxidase (GOx), and lipase. The total surface area of mesoporous SiO_2 microparticles prepared from silica colloidal solution was increased by 26-folds compared to that of dense SiO_2 particles (494 vs 19.0 $m^2\ g^{-1}$, respectively). Mesoporous SiO_2 particles showed 236, 174, and 203% higher protein loading for lipase, GOx, and HRP, respectively, than dense SiO_2 particles. The highest protein loading (288 mg g^{-1} after 24 h) and immobilization efficiency (210%) were observed for lipase from Thermomyces lanuginosus. The V_{max} and catalytic efficiencies of immobilized lipase were 3.80 and 5.90 folds higher than that of free enzyme. Contact angle analysis revealed increased hydrophobicity of the mesoporous particles, which is advantageous for lid opening at the active center, and increased activity after immobilization. Additionally, mesoporous SiO_2 particle-bound lipase retained 91% activity after 5 h at 70°C compared to free enzyme. We next developed a lipase/SiO_2/glassy carbon electrode (GCE) biosensors. Cyclic voltammetric results showed linear responses of the lipase/SiO_2/GCE bioelectrode towards tributyrin (50–300 mg dL^{-1}) as a surface-limited reaction in Tris-HCl buffer. After 12 repetitive uses, dense SiO_2- and mesoporous SiO_2-bound lipase retained 74.2 and 95.4% of its original activities, respectively. Thus, given their desirable characteristics and industrial utility, greatly porous SiO_2 particles may provide an excellent support for enzyme immobilization in biosensor development or biocatalysis in organic media.

R110-A

Immobilization of Xylanase Using a Protein-Inorganic Hybrid System

Sanjay K. S Patel, Raviteja Pagolu, Rowina Lestari, **Mr. Seong Hun Jeong**, Tae-Doo Kim and Jung-Kul Lee
Konkuk University, South Korea

In this study, the immobilization of xylanase using a protein-inorganic hybrid nanoflower system, was assessed to improve the enzyme properties. The synthesis of hybrid xylanase nanoflowers was very effective at 4° C for 72 h, using 0.25 mg/mL protein, and efficient immobilization of xylanase was observed with a maximum encapsulation yield and relative activity of 78.5% and 148%, respectively. Immobilized xylanase showed high residual activity at broad pH and temperature ranges. Using birchwood xylan as a substrate, the V_{max} and K_m values of xylanase nanoflowers were 1.60 mg/mL and 455 $\mu mol \cdot min^{-1} \cdot mg$ $protein^{-1}$, compared with 1.42 mg/mL and 300 μ mol/min/mg protein, respectively, for the free enzyme. After 5 and 10 cycles of reuse, xylanase nanoflowers retained 87.5% and 75.8% residual activity, respectively. These results demonstrate that xylanase immobilization using a protein-inorganic hybrid nanoflower system is an effective approach for its potential biotechnological applications.

R111-A

Fe2O3 yolk-Shell Particle-Based Laccase Biosensor for Efficient Detection of 2,6-dimethoxyphenol

Mr. Tae-Doo Kim, Sanjay K. S Patel, Raviteja Pagolu, Sang-Uk Lee and Jung-Kul Lee
Konkuk University, South Korea

The structural morphology and composition of a support play a key role in the performance of nanoparticle-based enzymatic biosensors. In the present study, the influence of different functional groups, including glutaraldehyde, 3-aminopropyltriethoxysilane, carbodiimide, cyano, and polyethyleneimine for the immobilization of laccase on synthesized Fe_2O_3 yolk-shell and commercially available Fe_2O_3, $SrFe_{12}O_{19}$, and $Y_3Fe_5O_{12}$ particles was analyzed. Glutaraldehyde-activated particles showed higher laccase activity after immobilization and higher relative detection currents for 2,6-dimethoxyphenol (2,6-DMP).

The multi-shelled structural morphology of Fe_2O_3 yolk-shell particles significantly improved the biosensing properties of immobilized laccase compared to that of spherical pure Fe_2O_3 and composite $SrFe_{12}O_{19}$ and $Y_3Fe_5O_{12}$ particles. The prepared biosensors showed high selectivity towards 2,6-DMP, with a sensitivity of 452 μA/mM/cm^2. Under optimum conditions, the linear ranges of detection were as follows: 2,6-DMP (0.025–750 μM), guaiacol (0.10–250 μM), pyrogallol (0.25–250 μM), and 3,4-dihydroxy-L-phenylalanine (1.0–125 μM), with limit of detection values of 0.010, 0.052, 0.093, and 0.273 μM, respectively. Laccase immobilized on bio-friendly multi-shelled Fe_2O_3 yolk-shell particles showed a broad linear range of detection, the lowest limit of detection, high sensitivity and stability, good reproducibility, anti-interference and recovery, and insignificant inhibition by laccase inhibitors.

R113-A

SnO2 hollow Nanotubes: a Novel and Efficient Support Matrix For Enzyme Immobilization

Zahid Anwar, Primata Mardina, Tae-Doo Kim, **Mr. Seong Hun Jeong** and Jung-Kul Lee
Konkuk University, South Korea

A major challenge in the industrial use of enzymes is maintaining their stability at elevated temperatures and in harsh organic solvents. In order to address this issue, we investigated the use of nanotubes as a support material for the immobilization and stabilization of enzymes in this work. SnO_2 hollow nanotubes with a high surface area were synthesized by electrospinning the $SnCl_2$ precursor (mixed in dimethyl formamide and ethanol) in polyvinylpyrrolidone. The electrospun product was used for the covalent immobilization of enzymes such as lipase, horseradish peroxidase, and glucose oxidase. The use of SnO_2 hollow nanotubes as a support was promising for all immobilized enzymes, with lipase having the highest protein loading value of 217 mg/g, immobilization yield of 93%, and immobilization efficiency of 89%. The immobilized enzymes were fully characterized by various analytical methods. The covalently bonded lipase showed a half-life value of 4.5 h at 70 ° C and retained ~91% of its original activity even after 10 repetitive cycles of use. Thus, the SnO_2 hollow nanotubes with their high surface area are promising as a support material for the immobilization of enzymes, leading to improved thermal stability and a higher residual activity of the immobilized enzyme under harsh solvent conditions, as compared to the free enzyme.

R102

Release of Sodium Salicylate from Hydrogels Prepared from Wheat and Arrowroot Starches

Asst. Prof. Patcharaporn Thitiwongsawet, Choolchinda Chandratat, and Sutee Boonnoppornkul
Faculty of Engineering, Thammasat University, Thailand

Sodium salicylate (SS), a non-steroidal anti-inflammatory drug, was loaded into starch-based hydrogels and the release characteristics of SS therefrom was studied. The hydrogels were prepared from wheat and arrowroot starches and crosslinked with either glutaraldehyde or sodium tetraborate decahydrate (borax). SS was loaded into hydrogel at concentrations of 10 and 20%w/w based on dry weight of sample. The study of release characteristics was carried out by total immersion method for 24 h in an acetate buffer solution (pH 5.5) at 32 ℃ as the same condition of human skin. A burst release of SS at the initial time followed by a gradual release to reach a plateau was observed. The maximum amounts of SS released from the hydrogels were about 8-22 mg. The amount of water retention of hydrogels was also determined at the same condition with that of the study of release. The hydrogels with the greater amount of water retention showed the higher release of SS. The hydrogels crosslinked with borax had higher amounts of SS released than those

crosslinked with glutaraldehyde. The hydrogels containing 20% SS-loaded showed higher amounts of SS released than those containing 10% SS-loaded. The hydrogels prepared from arrowroot starch showed higher amounts of SS released than those prepared from wheat starch. From the study of release kinetics based on the Korsmeyer-Peppas model, the exponents of release (n) of all specimens were close to 1 which indicated Case II diffusion.

R073

Experimental Investigation on Aerosol-Particle Sustaining Characteristics of a Porous-Walled Tubeanalysis from Endodontically Treated Tooth

Kyungwon Kim, Brandon Y. Boeur, Sinjae Hyun, **Prof. Cheolwoo Park**
Kyungpook National University, South Korea

In the present study, we experimentally investigated the aerosol-particle sustaining features of a porous-walled rubber foam tube model according to outlet humidity and temperature variations. An oleic acid aerosol is used as the inlet working fluid and the embedded particle diameters are in the range of 6–10 μm. To analyze particle size distribution, a wide-ranging particle spectrometer is employed, and particle sizes are measured at the inlet and outlet of the tube. Variance analysis is performed to evaluate the significance level of various tube-wall conditions, including dry and moist aerosol conditions at room and body temperatures. For the cases of larger particle sizes, the sustaining rates are increased when the porous wall condition is moist and at body temperature.

EM3007

Strength and Durability of High Performance Concrete Doped New Low Clinker Cementing Material

Assoc. Prof. Shuai Huang, Yuejun Lyu and Yanju Peng
Institute of Crustal Dynamics,China Earthquake Administration,China

A new low clinker cementing material applying to different concrete strength is developed in this paper. The experiential results show that standard consistency water consumption of the new material is less than the ordinary material; and the particle size is better than the ordinary material. And the cracking performance of the concrete made by the new material is far better than the performance of the concrete made by the ordinary material. Furthermore, the shrinkage of the concrete made by new material is less; and the resistance ability to carbonation is higher. Especially, our proposed new material could make the gel body dense and become six components of concrete into four, which simplifies the production process of concrete mixing station. At the same time, the prepared concrete made by the new material has better construction performance, volume stability and high durability. Unfortunately, the initial and final setting time of the new material are slightly longer. However, the initial and final setting time are still able to meet the national requirements. And most of all the new material meets the requirements of green high performance concrete.

EM3008-A

Three-dimensional Array of Bi2S3 Nanorods Grown on Carbon Textiles as a Cathode for Flexible Lithium-Oxygen Battery

Chaozhu Shu, **Mr. Anjun Hu** and Jianping Long
Chengdu University of Technology, China

Flexible and wearable power sources are crucial for the realization next-generation flexible electronics., However, their the application of the state-of-art Li-ion batteries in such

devices is hindered by thetheir low theoretical energy density. Thus, it is imperative to develop batteries with high energy density. Rechargeable lithium-oxygen (Li-O2) batteries are considered as the most promising candidates for these applications due to their excellent theoretical energy densities, while the conventional Li-O2 battery is bulky, inflexible and limited by the absence of effective components and an adjustable cell configuration. Here a new composite electrode of Bi2S3 nanorods coupled with carbon textiles is fabricated to be employed as the cathode for flexible Li-O2 battery. The as-prepared cathode reveals a we show that a flexible Li-O2 battery can be fabricated using Bi2S3 nanorod arrays grown onto Carbon textiles (Bi2S3 NAs/CT) as a free-standing cathode and that superior electrochemical performances can be obtained even under stringent bending and twisting conditions. This flexible cathode shows potential application in flexible and wearable power sources.

EM3010-A

Preparation of Two-dimensional Bismuth Sulfide Composite Foam Nickel Cathode Material as Li-O2 Battery High Efficient Catalyst

Mr. Zhiqian Hou, Yunhan Liu, Jianping Long, Chaozhu Shu
Chengdu University of Technology, China

The electrode two-dimensional bismuth sulfide/foam nickel composite material was prepared by hydrothermal method, which avoided the occurrence of the discharge side reaction when the binder and the carbon substrate were used as the electrode. The morphology and phase of the composites were characterized by using scanning electron microscope (SEM) and X-ray diffractionmeter (XRD). The electrochemical performances of air electrode were studied by cyclic voltammetry and constant current charging/discharging. The results show that the battery using two-dimensional bismuth sulfide/foam nickel composite material as the air electrode(2D-Bi2S3/NF) can reduce the overpotential in the process of charging/discharging, and the charging voltage is under 3.82V in 100 cycles.

EM3011-A

New Metal-Organic Frameworks based on 2,3-Pyridinedicarboxylic Acid for White LED

Assoc. Prof. Haiying Du and Youxi Wang
Chengdu University of Technology, China

White LED is known as the green light source, has a huge market demand. Phosphors play a key role in the optical performance of white LED, making it possible to create commercially available luminescent materials[1]. MOFs is an organic-inorganic hybrid material that combines the flexibility of organic materials and the rigidity of inorganic materials, and has become one of the important leading materials for new luminescent materials[2-3]. The photophysical properties of organic ligands in MOFs play an important role in their fluorescence excitation-emission and lifetime. Therefore, the creation of organic ligands has important research significance and value. New white-light-emitting MOFs based on ligand of 2,3-H2PDC were successfully synthesized via the solvothermal method. The structures were analyzed by PXRD, FT-IR, TG analysis and element analysis. The fluorescence spectra were obtained to investigate its fluorescence property. We try to find out the optimum synthesis temperature, the optimum proportion of Dy3+ and 2,3-H2PDC and the effect of matrix and dye. The result shows that 90℃ is relatively optimum synthesis temperature. After following experiments under synthesis temperature of 90℃ at λex=300 nm, the fluorescence intensity increases and then decreases with increases of proportion of Dy3+ and 2,3-H2PDC and fluorescence intensity reaches the top when proportion of Dy3+ and 2,3-H2PDC is 1:3. Meanwhile, CIE coordinates of [Dy(PDC) (H2O)2] ĐDMF0.66 at (0.2935, 0.3335) is near to the pure white-light CIE coordinates of (0.3333,0.3333)

EM3012-A

Synthesis and Photoluminescence Enhancement of Ca3Sr3(VO4)4:Eu3+ red Phosphors by Sm3+ doping for White LEDs

Mr. Qinxue Tang, Kehui Qiua, Wentao Zhang, Yuqiao Sheng and Junlan Wang
Chengdu University of Technology, China

A new type of red-emitting Eu3+ and Sm3+ co-doped Ca3Sr3(VO4)4 phosphor was synthesized by the combustion method. The photoluminescence properties and microstructure were investigated by photoluminescence spectroscopy, X-ray powder diffraction, and scanning electron microscopy. All samples were found to match perfectly with the rhombohedral structure and belong to the R3c space group. The photoluminescence emission intensity of the optimal phosphor Ca3Sr3(VO4)4:0.05Eu3+,0.09Sm3+ at 619 nm was significantly enhanced compared with those of Ca3Sr3(VO4)4:Eu3+ samples and commercial Y2O3:Eu3+ at an excitation wavelength of 393 nm, as a result of the energy transfer from Sm3+ to Eu3+. The energy transfer process between Sm3+ and Eu3+ is discussed and interpreted by considering the energy level diagram. Furthermore, the CIE chromaticity coordinate of Ca3Sr3(VO4)4:0.05Eu3+,0.09Sm3+ was closer to the standard red-emitting point (x=0.67, y=0.33) than Y2O3:Eu3+. The luminescence performance of Ca3Sr3(VO4)4:Eu3+,Sm3+ upon excitation by near-UV radiation makes it a promising red phosphor for manufacturing white-light-emitting diodes.

Listener

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Central African Republic

One Day Visit--Fukuoka

Date: 22 Jan. 2018(Monday)

Time: 9:00-18:30

Attention:

- This visit will charge **100USD** for each**.** (Pay to join before Jan. 10, 2018);
- or you could choose to enjoy free time on Jan. 22 to explore Fukuoka city by yourself;
- (Jan. 22)**8:50 AM**, pick up at gathering spot.
- Please be there on time, or you will miss the visit.

Route：

you will visit:

Dazaifu -- Dazaifu Tenmangu -- Kyushu National Museum —Kushida Shrine —Hakata Machiya Folk Museum —Fukuoka Dome— Seaside Park —Fukuoka Tower

Time	Destination	Play-time
9:00-9:30	Dazaifu	30 min
9:30-10:00	Dazaifu Tenmangu	30 min
10:30-12:00	Kyushu National Museum	1.5 hour
12:20-13:20	Lunch Time(exclude)	1 hour
13:40-14:10	Kushida Shrine	30 min
14:30-15:30	Hakata Machiya Folk Museum	1 hour
15:50-16:30	Fukuoka Dome	40 min
16:40-17:20	Seaside Park	40 min
17:30-18:30	Fukuoka Tower	1 hour

Service includes:

- Transportation, Fuel, Parking fees, Entrance fees;
- English speaking tour guide;
- Lunch;
- Pick-up & drop-off at gathering spot.

Service excludes:

- Personal expenses (not mentioned above).

Remarks

• The itinerary / duration to visit may change without advance notice depending on group size or unexpected local situation.

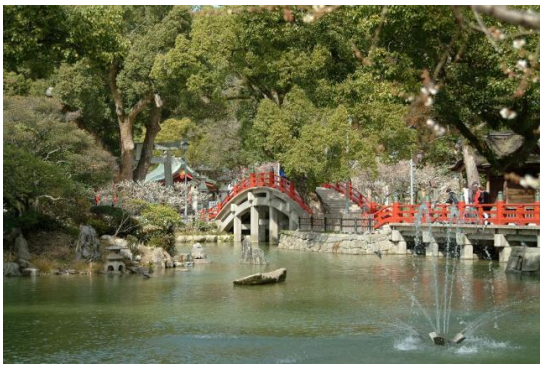
• The participants should go to the assembly point by themselves, no pick-up service.

Scenic Introduction:

No.1 Dazaifu (太宰府)


Dazaifu City, situated in central Fukuoka, is where "Dazaifu," the regional government for the entire Kyushu region, was established approximately 1,300 years ago. The city, together with Mt. Homan-zan and Mt. Sangun-san behind it, is part of the Dazaifu Prefectural Natural Park. The city abounds in historical s Mt. Homan-zan and Mt. Sangun-san ites reminiscent of the prosperity of Dazaifu in the old days. It is now a tourist spot representative of Fukuoka.

No.2 Dazaifu Tenmangu (太宰府 天满宫)

The shrine is dedicated to Sugawara Michizane who is known as the god of learning, it is busy all through the year with a lot of visitors praying for success in exams and academic achievement. 6000 plum trees are planted on the site and they start to decorate the shrine beautifully around early February to mid-March. It is said there are 200 kinds of plum trees, which were dedicated to the shrine from the temples of all around the nation.

The approach of the temple is always busy with many stalls selling popular local specialties such as Umegae-mochi(sweet rice cake with bean jam) which is associated with the plum trees, Gokaku Chikuwa (fish sausage) with kanji characters meaning success burnt on the surface, Usonomochi(sweet rice cake packed with a small bird of lucky charm) and Onigawara Monaka(sweet bean jam sandwithced in mochi wafers) which was produced after the archaeological discovery of Onigawara (ruin of old roof decoration) at the site of an old defense ministry office.

No.3 Kyushu National Museum(九州国立博物馆)


This is the forth-largest national museum in Japan following the ones in Tokyo, Kyoto and Nara. The concept of the museum is "capturing a formation of Japanese culture in the perspective of Asian history" and there are valuable exhibits depicting a blossoming relationship with Asian countries for a long time. The museum does not provide any guiding route, so you can start the tour from anywhere you like, and go back and forth between exhibitions as you wish. On the 1st floor is a hands-on learning facility of free entrance named Ajippa. Here you can put on ethnic costumes and play traditional musical instruments from Asian countries. Free back yard tour starting at 14:00 on Sundays is very popular. The tour gives you a rare opportunity to see the back scene of a museum with guidance.

No.4 Kushida Shrine(栉田神社)

This grand tutelary shrine of Hakata is widely known and people warmly refer to it as "Okushida-san".
It is dedicated to the gods of Ohatanushi-no-mikoto, Amaterasu-omikami and Susanowo-no-mikoto. According to tradition, in 757, when Emperor Koken was in the reign and Tairano Kiyomori designated Hakata port as a base of Japan-China trade, the shrine was built on the emperor's order to share a god with Kushida shrine of Ise province (the present Mie prefecture). In 1585 during the Hakata restoration, Toyotomi Hideyoshi contributed to rebuild the current main building of the shrine.
Hakata Gion Yamakasa festival, widely known as a summer feature of Hakata, is dedicated to this shrine. In the shrine yard, a great symbolic gingko tree grows with two monumental tablets of the Mongolian invasion on its foot.

No.5 Hakata Machiya Folk Museum(博多町家故郷館)


If you come to Hakata, why not learning about Hakata culture? This museum shows the old daily life and culture of Fukuoka city in Meiji and Taisho period, focusing especially on urban houses of that period. It is located across from the Kushida-shrine. The exhibition hall features the local tradition of Hakata Gion Yamakasa and such. You can also enjoy Hakata dialect lecture or take a look at a miniature town representing good-old days of Hakata. A demonstration of traditional hand crafting is also on exhibition here.

No.6 Fukuoka Dome(福冈巨蛋)


The Fukuoka Yahuoku! Dome is a baseball field, located in Chūō-ku, Fukuoka, Japan. Built in 1993, the stadium was originally named Fukuoka Dome and can accommodate 38,561 spectators. With a diameter of 216 meters, the Fukuoka Yahuoku! Dome is the world's largest geodesic dome. This is Japan's first stadium built with a retractable roof. In 2005, Yahoo! JAPAN, one of SoftBank's subsidiaries, acquired the stadiums naming rights, and thus renamed it Fukuoka Yahoo! Japan Domeor abbreviated as Yahoo Dome , In January 2013, it was renamed to Fukuoka Yafuoku! Dome . Yafuoku means Yahoo! Auctions in Japan.

No.7 Seaside Park (海滨公园)


This is a park with an artificial beach north of Fukuoka Tower. It is close to such landmarks as the public

library, public museum and Yafuoku! Dome. In the middle of the beach is also a bridal shop and restaurants (Marizon area). The beach is suitable for beach sports such as beach volleyball, soccer and jet skiing. At night, the lights of the urban night are reflected beautifully on the sea. This is one of Fukuoka's most popular dating spots.

No.8 Fukuoka Tower (福冈塔)


This tower of 234 meters above sea level is the tallest beach tower in Japan. This symbolic building of Fukuoka's western subcenter, covered by as many as 8000 half-mirrors and boasting a sharp appearance with its triangular structure, is known by the name of Mirror Sail. The panoramic view of Fukuoka city from the observation room on the 5th floor of 123 meters high is fantastic. The room is equipped with up-to-date telescopes. Come seasons of Tanabata (traditional star festival) or Christmas, the tower romantically decorates the night view of the city with illumination lights on its half mirrors. On the first floor are shops of local specialties such as Hakata's traditional confections or mentaiko (cod ovum), an eat-in cafe and a European style restaurant.

MEMO