

2019 X-ACADEMY HONG KONG CONFERENCE

2019 X-ACADEMY HONG KONG, CHINA

SCHEDULE

**2019 8th International Conference on Advanced Materials and
Engineering Materials (ICAMEM2019)**

Hong Kong, China

April 18-19, 2019

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Simple Version of the Schedule

ICAMEM2019 CONFERENCE SCHEDULE

April 18, 2019 (Thursday)	
14:00-17:00	Registration at REGAL ORIENTAL HOTEL
April 19, 2019 (Friday) at Conference room I – III	
9:00-12:15	Plenary Session & Keynote Session
9:00-9:40	Plenary speech 1: Prof. Katsuyuki Kida <i>Topic: Application of scanning Hall probe microscopy to metal fatigue</i>
9:40-10:20	Plenary speech 2: Ass. Prof. Koshiro Mizobe <i>Topic: Effect of tribological conditions on fracture behavior of printed and machined polymer bearings (PEEK, PPS and PTFE)</i>
10:20-10:40	Tea Break & Photo
10:40-11:20	Keynote speech 1: Prof. LAU, Denvid <i>Topic: Development of metallic glass composites</i>
11:20-12:00	Keynote speech 2: Prof. Takahiro Ohashi <i>Topic: Will be soon...</i>
12:00-13:00	Lunch
13:00-15:00	Session 1
15:00-15:10	Tea Break
15:10-15:40	poster session
15:40-17:00	Session 2

Committees

Internation Program Committee Chair (Taiwan)

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Dr. Hui-Mi Hsu, National Ilan University, Taiwan

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Osman Adiguzel, Department of Physics, Firat University

Yasin POLAT, Nevşehir Hacı Bektaş Veli University, Turkey

Internation Program Committee Chair (France)

Charafeddine Jama, Université de Lille, France

Venue

Conference venue: REGAL ORIENTAL HOTEL (香港富豪东方酒店)

Add: 30 - 38 Sa Po Road, Kowloon City, Hong Kong

Phone: (852) 2718 0333

Fax: (852) 2718 4111

Email: info@oriental.regalhotel.com

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Note:

1. All the participants are strongly advised to arrive before **8:50, April 19, 2019**.
2. Certificate of Participation can be collected at the registration counter.
3. Please copy PPT files of your presentation to the secretary when registration.
4. The organizer doesn't provide accommodation, and we suggest you make an early reservation.
5. If you want to deliver oral presentation but your paper is not in the session list, please contact us by Email: cfp@icamem.org (for ICAMEM2019)

Instruction about Oral Presentation

Devices Provided by the Conference Organizer:

Laptops

Projectors & Screen

Laser Sticks

Materials Provided by the Presenters:

PowerPoint or PDF files

Duration of each Presentation:

Regular Oral Session: about 7 Minutes of Presentation and 3 Minutes of Q&A.



Plenary Speech

April 19, 2019 (9:00-10:20)

Plenary Speech 1 9:00-9:40



Prof. Katsuyuki Kida

University of Toyama, Japan

Speech title: Application of scanning Hall probe microscopy to metal fatigue

Professor Katsuyuki Kida was born in 1968 in Osaka, where he studied mechanical engineering at Osaka University from 1988. Apart from course work, he studied rolling contact fatigue (RCF) occurring in TiC and TiN coated steels using both X-ray diffraction and scanning acoustic microscopy. After graduation he pursued his academic career and obtained a Ph.D. in engineering mechanics in 2000, investigating RCF problems of all-Si₃N₄ bearings. By observing cracking and flaking failure under RCF, he succeeded in explaining the material's features from the viewpoint of fracture mechanics. From 2000 he focused his work on investigating the contact problems of several materials used in machine elements. He has also continued fundamental research on contact problems, for which he received 'The Best Paper Prize (FFEMS PRIZE)' from 'Fatigue & Fracture of Engineering Materials & Structures' journal in 2005. The awarded papers reported establishing a crack growth mechanism under contact pressure, a problem previously unsolved for over 70 years since S. Way's proposed theory. His research interests now include the development of three dimensional scanning Hall-probe microscope technologies, fatigue phenomena in polymer bearing, crack growth mechanism under contact stresses and refinement of high-carbon steels. He holds and has held a number of prestigious leadership roles in academy-industry corroboration programs: refinement of steels, new joint system in humanoid robots and fatigue of polymer bearings in "Strategic Fundamental Technologies Strengthening Assistance Programs" (Ministry of Economics, Trade and Industry, Japan, 2009-2013); scanning Hall-probe microscopy in "Fundamental Studies on Technologies for Steel Materials with Enhanced Strength and Functions" (Consortium of the JRCM, Japan, 2008-2012); and ceramic bearing elements in the project supported by "Japanese Energy and Industrial Technology Development Organization" (NEDO, Japan, 2007-2011)." As a chairperson of department of mechanical engineering in University of Toyama, Professor Kida is heading education and research projects (2019-).



Plenary Speech 2 9:40-10:20



Ass. Prof. Koshiro Mizobe
University of Toyama, Japan

Speech title: Effect of tribological conditions on fracture behavior of printed and machined polymer bearings (PEEK, PPS and PTFE)

Koshiro Mizobe is an assistant professor in the Department of Mechanical Engineering at the University of Toyama, Japan. He has published over 50 papers in various research fields including: evaluation of stress intensity factors, repeated heating, homology evaluation of microstructure, and polymer bearings.

Koshiro studied mechanical engineering at Kyushu University, Japan, graduating in 2013. He studied the repeated quenching refinement method of high-carbon chromium steels in his PhD course. For this work he received the Research Fellowship for Young Scientists in 2013-2014 from the Japan Society for the Promotion of Science as well as Top Young Researcher Award in 2012 from Kyushu University. Since 2015 he has been an assistant professor in the Department of Mechanical Engineering at the University of Toyama. He has won some best paper awards from international committees (ICMDME, CMPSE and ICMTM) and received some grants (25th ISIJ research promotion grant from the Iron and Steel Institute of Japan and research promotion grant from JKA).

His current research topics with a brief explanation are as follows.

Repeated heating method

Martensitic high-carbon high-strength bearing steel is one of the main alloys used for rolling contact applications where high wear resistance is required. Refining the prior austenite grain size through repeated heating is a process commonly used to enhance the material's strength. He studied the effect of repeated heating on the microstructure near inclusions through the rolling bending fatigue tests.

Development of hybrid polymer bearings

Koshiro is focusing on polymer bearings because it is suitable for the no lubricant situation and the corrosive situations. In particular, he focuses on PEEK which is a tough semi-crystalline thermoplastic polymer and PTFE which has low friction coefficient. Now, he develops the combination of PEEK races-PTFE retainer bearings.



10:20-10:40	Photo & Coffee Break
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Keynote Speech

April 19, 2019 (10:40-12:00)

Keynote Speech 1 10:40-11:20



Ass. Prof. LAU, Denvi
City University of Hong Kong

Speech title: Development of metallic glass composites

Denvi obtained his Bachelor degree with first class honors and Master degree in Civil Engineering from the University of Hong Kong (HKU) in 2004 and 2006 respectively, and got his second Master degree from the Department of Civil and Environmental Engineering (CEE) at Massachusetts Institute of Technology (MIT) in 2009. He then received his Ph.D. in the field of structures and materials from MIT in 2012. Prior to joining the City University of Hong Kong as an assistant professor in August 2012, he worked as a postdoctoral associate at MIT. Denvi got various awards and scholarships during his undergraduate and graduate studies including the Croucher Foundation Scholarship (2006-2009) and the Marvin E. Goody Award (2007). He was named as one of the Harvey Fellows in 2011. His research focuses on the multiscale modeling of organic-inorganic system, moisture-induced debonding, durability of concrete-epoxy system and fiber-reinforced polymer (FRP) composites in structural rehabilitation. To date, Denvi has attracted over HK\$9 million fund in total for research and teaching development. He is currently the editorial board member of several international journals including Composites Part B: Engineering, which ranks top 5% in Engineering Multidisciplinary category in ISI. He has published more than 80 referred journal and conference articles and has delivered more than 25 invited talks around the world. Recently, Denvi has been nominated and selected as a Founding Member of the Young Academy of Sciences of Hong Kong (YASHK).

Keynote Speech 2 11:20-12:00



Professor Takahiro Ohashi
Kokushikan University, Japan

Head of Mechanical Engineering Department of Kokushikan University (December 2012-Present); Representative delegate of Japan Society for Technology of Plasticity (April 2016-Present); The board of trustees of Aluminum Forging Association in Japan; Experience in directing a national research project for a new die structure of Ministry of Economy, Trading and Industry (METI); Experience in directing 3 research teams of National Institute of Advanced Industrial Science and Technology (AIST)

Session List

Session 1

April 19, 2019 (13:00-15:00)

1. Paper ID: AM917

Title: Ni_{0.75}Fe_{0.25} coated tubular GDC Anode for cathode-supported IT-SOFC with high anode porosity

Authors: Hongxin You, Lian Peng and Qiang Wang

Abstract: Ni_{0.75}Fe_{0.25}Ox-GDC cermet anode for intermediate temperature solid oxide fuel cell was prepared by hard template method and wet impregnation method. LSC-GDC cathode-supported single cell was fabricated by using Ni_{0.75}Fe_{0.25} coated tubular GDC as anode for the performance test. The composite anode material with Ni-Fe alloy particles coated tubular GDC was analyzed by XRD and SEM. The maximum power density of the single cell in hydrogen and dry methane was 736 and 400 mW•cm⁻² at 800 °C, respectively. The SEM observation showed that the anode had a porous three-dimensional microstructure with high specific surface and rich gas channel, resulting a high power generation performance.

2. Paper ID: AM921

Title: Desorption of Mercury Complex from Fe-modified Montmorillonite Adsorbent Membrane

Authors: LODO Marjorie Jane and DIAZ Leslie Joy



Abstract: With the use of nanotechnology, clay minerals, specifically montmorillonites, have been reengineered to be used in environmental remediation, especially in the treatment of mining wastewater containing hazardous heavy metal ions. The objective of this study is to assess the practicality of using iron-modified montmorillonite (Fe-MMT) nanomembranes in the removal of mercury using the adsorption process. The nanomembranes, which were synthesized via electrospinning, were subjected to mercury cyanide solutions during the batch adsorption set ups to determine the adsorption efficiency. During the subsequent elution tests, three factors– eluent type (CH₃COOH and C₆H₈O₇), eluent concentration (0.01 M and 0.05 M) and contact time (3 and 5 hours) – were tested. SEM images of the mats were acquired to study the structure of the adsorbent. HD XRF analysis was done to identify the ions present in the membrane, as well as the initial Hg concentrations, amount of remaining Hg in the wastewater after batch adsorption and amount of desorbed metal. Results showed that using the Fe-MMT nanomembrane as adsorbent material resulted to 61.74% removal of Hg in the mercury cyanide solutions with initial concentrations of 13.87 to 38.9 mg L⁻¹. Acetic acid exhibited better desorption results, with the highest efficiency of 31.36% (0.01 M, 5 h) compared to citric acid's 7.40% (0.05M, 3 h).

3. Paper ID: AM934

Title: Preparation and Pervaporative Ethanol Dehydration of MOR Zeolite Membranes Crystallographically Oriented by Using Needle-like Seed

Authors: Byung-Jin Yoon, Young-mu Kim, Du-Hyeong Kim and Churl Hee Cho

Abstract: Mordenite (MOR) zeolite membrane has received much attention due to the solvent dehydration performance and acid stability. The acid stability comes from the Si/Al molar ratio of 3 to 5. In case of LTA zeolite membrane, the Si/Al ratio is 1, so that LTA zeolite structure is chemically unstable under acidic condition. Even though some literatures already reported pervaporative ethanol dehydration data of MOR zeolite membranes, dehydration performance was insufficient, when comparing with that of LTA zeolite membrane. Reported water flux of MOR zeolite membranes was ~ 0.2 kg/m²h and reported water/ethanol separation factor, less than 200 for 10wt.% water-alcohol mixtures. For alcohol dehydration applications, it is required to improve pervaporative alcohol dehydration performance of MOR zeolite membranes, especially both water flux and separation factor. In the present study, crystallographically b- and c-axis oriented mordenite zeolite membranes were prepared and their pervaporative ethanol dehydration was investigated. The crystallographic orientation was controlled by changing amount of c-axis elongated mordenite seeds dip-coated on the surface of α -alumina support. During seed coating, c-axis of needle-like seeds was parallelized to the support, in other words, b-axis was perpendicular to the support surface. The c-axis terminations of seeds were randomly oriented on the support. As seed concentration increased, seed coverage on the support increased. The seeded supports were hydrothermally treated at 170°C for 24 hours to induce secondary growth. The seed layer with a high coverage grew to be c-axis oriented dense layer since c-axis growth of needle-like seeds was prevented by blocking with others. On the other hand, the seed layer with a low coverage grew to be b-axis oriented layer since c-axis growth of seed



was not interfered with others. Those membranes were pervaporation tested for a water-ethanol mixture. The b-axis grown membrane with 8-membered rings showed a high separation factor of above 1000 and a considerable total flux of around 0.2 kg/m²h. The c-axis grown, columnar structured membrane with 8- and 12-membered rings showed a low separation factor of less than 200 and a relatively high total flux of around 0.25 kg/m²h. The high performance of b-axis grown membrane was due to the relatively small opening of 8-membered rings. Water molecules can freely permeate through the openings, but ethanol molecules, difficultly. Therefore, in the present study, we introduced a new method to control crystallographic orientation of mordenite membrane by changing seeding amount of needle-like crystals, and elucidated that b-axis oriented mordenite membrane showed better performance than c-axis grown mordenite membrane.

4. Paper ID: 4**Title:** Effect of Aspect Ratio on Horizontal Field Magnetoresistance**Authors:** Toempong Phetchakul, Yothin Chemthung and Amporn Poyai

Abstract: This paper studies the aspect ratio (W/L), width (W) per length (L) of semiconductor resistor based on Hall effect current mode for horizontal magnetic field. At low concentration, 10^{14} cm⁻³, $W/L < 1$, the length has direct effect to magnetoresistance. The $W/L = 1$, the large resistor provides magnetoresistance better than small device. The $W/L > 1$, the width has inversely proportional to magnetoresistance. The $\%MR(B)$ is around 1% at 0.5 T, 1 mA. The long resistor ($W/L < 1$) can create ΔR in the order of several kilo ohms and several hundred ohms for short resistor ($W/L = 1$). The contribution factors $\rho(L/W)$ for high ΔR are low concentration and aspect ratio ($W/L < 1$). The high $MR(B)$ is contributed by high current density of short structure ($W/L = 1$). At high concentration 10^{17} cm⁻³, aspect ratio and magnetoresistance are not sensitive to magnetic field because the Hall effect hardly occurs in high concentration material.

5. Paper ID: 18**Title:** Synthesis of Cerium Phosphate White Pigments from Cerium Oxalate**Authors:** Hiroaki ONODA and Rie TANAKA

Abstract: Catalytically active cerium dioxide is used as light reflection materials for cosmetic applications. Therefore, cosmetics containing this pigment too much cause oxidation of the skin. Therefore, the substitute for cerium dioxide is required to prepare the cosmetics without catalytic activity. Herein, as novel white pigments for use in cosmetics, cerium phosphates were prepared from cerium oxalate under various conditions. The chemical composition, powder properties, catalytic activity, color phase, and smoothness of the cerium phosphates were evaluated. All samples had weak unknown peaks in XRD patterns. Samples prepared at high temperature and for long time indicated the peaks of phosphate in IR spectra. Samples prepared in this work had no photo and oxidation catalytic activities. Samples prepared at high temperature and for long time indicated enough high whiteness and high smoothness.

6. Paper ID: 23**Title:** Path planning for accurate surface shaping using a robotic grinding system



Authors: DIDI CHAOUI Mohamed, LEONARD François and ABBA Gabriel

Abstract: In this paper a robotic grinding system which can produce a finished workpiece that respects some product geometric specifications is proposed. It is composed of a 1 DoF active compliance actuator fixed between the grinder and the robot. The 1 DoF actuator associated to the tool can be mounted at existing robotic installations which make this solution very flexible and easy to use by the industrials. The grinding system composed of the robot and the actuator is able to apply a constant contact force between the workpiece and the grinding tool. A path planning method is also presented in this article. Using analytical calculations, the robot path is determined for surface and corner grinding of a parallelepiped workpiece with a given precision of the surface shape.

7. Paper ID: AM928

Title: Optical and Electrical Properties of Diamond-Like Carbon Thin Film With Deposition by ECR-CVD System

Authors: Tanawit Srisantirut and Weera Pengchan

Abstract: In this paper, evolution of optical and electrical properties of diamond-like carbon (DLC) films deposited by ECR-CVD system are reported. By varying the deposition different substrates bias (0, -55, -100 V) and volume amount of C₂H₂ from 40 to 55 cc onto substrate Si/TiN and quartz. The structure of the DLC films were analyzed from Raman spectroscopy. DLC films deposited bias at -100 V and C₂H₂ at 40 cc show excellent optical transmittance and high resistivity. As a result, ID/IG ratio corresponds to the optical transmittance and resistivity with ID/IG ratio decreased making the film like to the diamond. Most importantly, the transparency and resistivity properties of the DLC films can be tailored to approaching diamond by adjusting substrates bias and volume C₂H₂, is important to many applications, which is improve film properties.

8. Paper ID: 52

Title: Effects of CeO₂ addition on slip – cast Yttria Tetragonal Zirconia Polycrystals toughened Alumina (ZTA)

Authors: Sivakumar Sivanesan, Teow Hsien Loong, Satish Namasivayam and Mohammad Hosseini Fouladi

Abstract: The effects of adding CeO₂ into ZTA were studied in terms of the resulting microstructure and mechanical properties. CeO₂ was detected with significant amounts only above 10 wt%. Additions of CeO₂ of more than 10 wt% was found to have exceeded the solubility limit and formed a new phase which is Ce₂Zr₃O₁₀. The formation of this new phase increases the tetragonality factor of ZTA ceramics. Ce₂Zr₃O₁₀ prevents excessive grain growth through a pinning effect which is attributed to the segregation of Ce₂Zr₃O₁₀ to the grain boundaries. Fracture toughness was found to exhibit a maximum value of 9.3 Mpa^m^{1/2} with 10 wt% additions of CeO₂. Further additions of CeO₂ was not beneficial in enhancing the fracture toughness due to the formation of Ce₂Zr₃O₁₀ which tends to reduce the mechanical strength of ZTA. A maximum hardness value of 17700 MPa was recorded for ZTA with 10 wt% CeO₂. Further additions of CeO₂ was detrimental to the hardness of ZTA due to the formation of Ce₂Zr₃O₁₀. Theoretical densities were observed to be always higher than measured densities due to the effect of porosity which was promoted during sintering.



9. Paper ID: 53

Title: Two-Stage Sintering of Alumina-Y-TZP ($Al_2O_3/Y-TZP$) Composites

Authors: Sivakumar Sivanesan, Teow Hsien Loong, Satish Namasivayam and Mohammad Hosseini Fouladi

Abstract: Alumina-Zirconia composites with varying vol % from 0 to 25 vol % Y-TZP were produced via conventional sintering with temperature ranging between 1300°C and 1550°C, heating rate of 10°C/min and dwelling time of 30 minutes to 2 hours. The sintered composites were then evaluated on the bulk density, Vickers hardness, Young's modulus and fracture toughness. Based on the experiments conducted, it is observed that addition of Y-TZP into the alumina matrix increases the bulk densities as Y-TZP contents increases. It is also revealed that samples < 10 wt% Y-TZP sintered at 1450°C was able to achieve > 98 % T.D. and KIC > 6 MPam^{1/2} when compared to monolithic alumina ceramics. In addition, samples with Y-TZP content < 10 vol % Y-TZP was able to achieve maximum hardness (> 15 GPa) when sintered at 1500°C.

10. Paper ID: 56

Title: Catalytic Cracking of Oleic Acid over Zeolites

Authors: Md Amirul Alam Kanak, Ji-Yeon Park and In-Gu Lee

Abstract: Compared with bio-oil from sawdust (common lignocellulosic biomass), the bio-oil obtained by fast pyrolysis of coffee waste has a unique feature to contain a significant amount of fatty acids such as oleic acid and palmitic acid. It is necessary to conduct C-C cracking of fatty acids present in coffee-waste bio-oil to maximize gasoline fraction (C₅-C₁₂) production. In this work, catalytic cracking of oleic acid as a model compound for the fatty acids was carried out in batch reactors to understand the effect of major parameters such as zeolite type (HZSM-5, SAPO-11, MCM-41), reaction temperature (380-500 °C), and reaction time (0-50 min) on gasoline fraction production. The GC-MS analysis showed hydrocarbons and aromatics to be major compounds present in the gasoline fraction irrespective of zeolite type and reaction conditions. At 400 °C and 0 min reaction time, the yield of gasoline fraction was 18.6, 6.7, and 33.1 % with HZSM-5, SAPO-11, and MCM-41, respectively. As reaction temperature increased to 500 °C, the total gasoline fraction yield reached 43.7 and 22.7 % with SAPO-11 and MCM-41, respectively. In all the catalysts, the content of aromatic compounds in the gasoline fraction increased with the increase in reaction temperature and reaction time. Meanwhile, the formation of hydrocarbons in the gasoline fraction showed different optimum temperature with catalyst: 11.8 % yield with SAPO-11 at 500 °C and 27.0 % yield with MCM-41 at 400 °C.



15:00-15:10

Coffee Break

Poster Session

April 19, 2019 (15:10-15:40)

1. Paper ID: 3

Title: High-voltage capability electrode constructed by anchoring vanadium oxide on conductive paper toward quasi-solid-state supercapacitor

Authors: Ming-Jay Deng and Tzung-Han Chou

Abstract: Designing nano-scale electrodes has been proven to be an efficient way for improving the performance and stability of supercapacitors. Herein, we successfully fabricated 3D network vanadium oxide and manganese oxide nanofibers on conductive paper as electrodes linked with an eco-friendly deep eutectic solvent-based quasi-solid-state electrolyte for high-voltage quasi-solid-state supercapacitors. As a result, the high-voltage quasi-solid-state supercapacitors are able to work with a huge operating voltage of 4.2 V, and supply outstanding energy and power densities (>200 W h/kg at 1800 W/kg and >90 kW/kg at 90 Wh/kg). The high-voltage quasi-solid-state supercapacitors demonstrate remarkable cycling stability and durability after 6000 cycles, including bending and twisting (capacitance retention >90%). The quasi-solid-state supercapacitors are a greater prospective candidate for flexible electronic devices and Internet of Things (IoT) applications.

2. Paper ID: 24

Title: Flame retardant performance of wood-magnesium board laminated composite treated with flame retardant chemical by using SBI(single-burning-item) test

Authors: Hee-jun Park, Seok-un Jo, Chun-won Kang

Abstract: The present study investigates flame retardant performance of the wood-veneer(0.8mm) and magnesium board(6.0mm) laminated panels(WM board) treated with flame retardant chemical(FRC).

The wood veneer and the magnesium board were made to adhere with EVA adhesive, and then treated with FRC for their flame retardant performance by using SBI(single-burning-item, BS EN 13823).

The results showed that FIGRA (fire growth rate) & THR (total heat release) of the wood-magnesium board laminated composite are satisfied with the A2 rating of the reaction to fire performance of building products in Europe has been applied to wood-based panels.

In conclusion, the WM board treated with flame retardant chemical preserve the advantages of wood and improve the disadvantages of mineral materials (magnesium board) as the building material of preventing fire.

3. Paper ID: 25

Title: Structural Analysis of Fire Extinguisher Storage Made of GFRP for Railway Vehicles

Authors: Hon Chung Shin, Ji Ho Ahn and Gyo Woo Lee

Abstract: The purpose of this study is a structural analysis of the fire extinguisher storage box for changing the material from stainless steel to composite material in order to



lighten the storage box installed in the railway vehicles. The material and the thickness of the storage box were varied and analyzed. When the material of the storage was changed from stainless steel to glass fiber reinforced composite material, the amount of stress applied to the box decreased, but the deformation increased. When the thickness of the storage box made of GFRP was 3 mm, the weight reduction of 50% was achieved. In this case, the deformation was increased approximately 5 times compared to that of stainless steel, but the value was less than 15 μm which means very small deformation. For the additional weight reduction, Case 1 which has a side wall thickness of 2 mm was proposed for the detailed design. In this, the weight reduction was 59%.

4.Paper ID: 28

Title: Low Cycle Fatigue Life Evaluation According to Temperature and Orientation in Nickel-base Superalloy

Authors: In Kang Heo, Donghyun Yoon and Jaehoon Kim

Abstract: Components of gas turbines must be extremely resistant to high temperatures, high stresses, high-temperature corrosion, and erosive environments. The materials used in these environmental conditions are mainly nickel-based superalloys. In this study, the low-cycle fatigue of the nickel-based superalloy Inconel 792 was examined. The total strain range of a gas turbine between 760 °C and 870 °C was considered as the parameter representing the actual gas turbine operation. In addition, tests were performed using a trapezoidal waveform of the total strain to reflect the operation-stop conditions of a gas turbine with frequent shutdowns. The results of the fatigue test were compared with the Coffin–Manson method and energy method. The fractured surface was analyzed using a scanning electron microscope (SEM).

5.Paper ID: 31

Title: Comparison of Mechanical Properties of Plain and Reversed Curve Nickel-Titanium Archwires

Authors: Kanuengnit Pongpat, Niwat Anuwongnukroh, Surachai Dechkunakorn, Wassana Wichai and Peerapong Tua-ngam

Abstract: In orthodontics, nickel-titanium wires are used for teeth alignment and leveling. For leveling the curve of Spee, reversed curve archwires are often used to increase the vertical force needed to correct a deep bite.

6.Paper ID: 32

Title: Shear Bond Strength of Experimental Light-cured Orthodontic Adhesives

Authors: Kanin Nimcharoensuk, Niwat Anuwongnukroh, Surachai Dechkunakorn^{1,c}, Vanthana Sattabanasuk, Wassana Wichai and Panya Sunintaboon

Abstract: The objective of this study was to compare shear bond strength (SBS) and adhesive remnant index (ARI) of domestically made orthodontic adhesives to a commercial orthodontic adhesive, Transbond XT (3M Unitek, USA). Three formulas of an in-house orthodontic adhesive were divided according to monomer ratio (BisGMA:TEGDMA) into group 1 (8:2), 2 (7:3), and 3 (6:4), respectively, with 60-70 weight % of filler amount and 0.5 % of photoinitiator (TPO). Eighty upper human premolars (20 of each group) were bonded with stainless-steel brackets with these experimental and control adhesives. All were cured by LED light-cured unit for 20



seconds. After polymerization for 24 hours, a universal testing machine was used to apply an occlusal shear force to the enamel/bracket interface at a speed of 0.5 mm/min. The ARI scores were evaluated for each debonded tooth. Mean SBS values were analyzed statistically using the One-way ANOVA and the Tukey's test for multiple comparison. Chi-square test was used to determine significant difference in the ARI scores. The results showed that there was statistical difference in the mean SBS of 4 groups ($P < .001$). The SBS value of group 1, 2, 3, and control was 18.79 MPa, 18.58 MPa, 23.30 MPa, and 28.02 MPa, respectively. Chi-square comparison for the ARI indicated that there was significant difference ($P = .012$) between the groups. In conclusion, the experimental adhesive of group 3 yields the higher SBS than in group 1 and group 2. Although these adhesives provide a lower shear bond strength than Transbond XT, they were acceptable for clinical use. Most failures of Transbond XT were found between adhesive-bracket interface, whereas the three in-house experimental adhesives were found mixed failure patterns of ARI.

7.Paper ID: 33**Title:** Effects of Mixed Mode Loading Conditions on Fatigue Crack Growth Rate**Authors:** Sanghyun Hong, Sangdeok Kim and Jaehoon Kim**Abstract:** The fatigue crack growth rate is the most important factor in predicting the life of a product when applying the damage tolerance design concept. Studies related to pure mode I for structures under fatigue loading have been actively conducted, while not many studies are conducted on the mixed mode. In this study, therefore, mixed mode fatigue crack growth experiments were designed using the Compact-Tension-Shear (CTS) specimens and the loading devices, proposed by Richard. Furthermore, the finite element analysis was used in determining the stress intensity factors of CTS specimen. As the results, the fatigue crack growth rate using the equivalent stress intensity factors proposed by previous researchers was lower than that of pure mode I at the initial stage of crack growth when the load angle increases.**8.Paper ID:47****Title:** Axial Behavior of Columns Strengthened with Seismic RC Jacket Section**Authors:** Yong-Ha Hwang and Keun-Hyeok Yang**Abstract:** This study proposes steel bar prefabrication technology including V-type supplementary tie and closed hoops for seismic strengthening of deficient columns. The axial concentric behavior of the columns strengthened with proposed approach in the jacket section was examined using five full-scale specimens. Test results showed that the axial strength of the strengthened columns can be estimated conservatively in accordance with the prediction equations of ACI 318-14 approach. The axial ductility of the strengthened columns was 1.4 times as high as that of the existing column. Overall, the proposed technology is effective in enhancing the axial stiffness, strength, and ductility of the deficient columns.

**9. Paper ID: 21****Title:** An Intelligent Optimization System for PIM Process**Authors:** Wen-Chin Chen, Tai-Hao Chen, Ding-Tsair, Chang and Manh-Hung Nguyen

Abstract: This study proposes an intelligent optimization system based on the Taguchi method, back-propagation neural network (BPNN), multilayer perceptron (MLP) and modified PSO-GA to find optimal process parameters in plastic injection molding (PIM). Firstly, the Taguchi method is used to determine the initial combination of parameter settings by calculating the signal-to-noise (S/N) ratios from the experimental data. Significant factors are determined using analysis of variance (ANOVA). The S/N ratio predictors (BPNNs/N) and quality predictors (BPNNQ) are constructed using BPNN with the experimental data. In addition, a modified PSO-GA algorithm in conjunction with MLP is used to find initial weights of BPNN and to reduce the training time of BPNN. In the first stage optimization, the S/N ratio predictors are coupled with GA to reduce the variations of the manufacturing process. In the second stage optimization, The combination of S/N ratio predictors and quality predictors with modified PSO-GA is employed to search for the optimal parameters. Finally, three confirmation experiments are performed to assess the effectiveness of these approaches. The experimental results show that the proposed system can create the best performance, and optimal process parameter settings which not only enhance the stability in the whole injection molding process but also effectively improve the PIM product quality. Furthermore, experiences of the novel hybrid optimization system can be transferred into the intelligent PIM machines for the coming up internet of things (IoT) and big data environment.

10. Paper ID: 57**Title:** Throughput Estimation Model of Cluster Tool in Semiconductor Manufacturing**Authors:** Ying Mei Tu

Abstract: Semiconductor manufacturing management system was developed and grown up over the past decades. In order to increase the product yield and enhance the production productivity, cluster tools became the main stream in modern wafer fabrication factories which occupies over 50% of production equipment. Generally, cluster tools are integrated by several components including robots, vacuum chambers (Load locks) and single-wafer process chambers in a module and can be treated as a small factory. The throughput estimation before recipe release is very difficult. However, it is necessary and important for the planning activity. In this work, a throughput estimation model for cluster tools is proposed. The Multiple Regression Analysis is applied to develop a set of throughput estimation equations. A simulation model of cluster equipment including 3 single-wafer process chambers are built to get the historical throughput data for the regression analysis. From the Multiple Regression Analysis, it reveals that different numbers of recipes processed in the same time have to develop different regression model. The major factors in the regression model include numbers of load ports and process time of each recipe. Furthermore, a set of recipes are used to test the accuracy of estimation. Based on the testing results, they revealed that the MAPE is under 3% and the estimation model is accepted in practice to forecast the throughput of recipes for the planning activities.

**11. Paper ID: 26****Title:** Antibacterial properties among different concentration of bioactive glasses**Authors:** Tanawan Wanitwisutchai, Naruporn Monmaturapoj, Ratchapin Srisatjaluk, Kittitat Subannajui, Niwat Anuwongnukroh, Surachai Dechkunakorn and Pongprueksa**Abstract:** The objective of this study was to evaluate the antibacterial properties and pH changes of bioactive glasses and zinc oxide nanowire in different concentrations. Bioactive glasses (45S5 and 45S5F) were prepared in three concentrations of 10, 20, and 50 mg/ml and zinc oxide nanowire was prepared in 1 and 5 mg/ml concentrations. The materials were exposed to 500 ml brain heart infusion broth (BHI) with 1.5×10^7 of *S.mutans* and *S.sanguinis* separately. Antibacterial properties were tested indirectly by collecting 100 ml of each sample and transferred into a 96 well-plate. The optical density (OD) was evaluated using spectrophotometry at 630 nm at 24h and 48h. The pH changes were recorded. The data were statistically analyzed by Kruskal-Wallis tests. The result showed that the pH changes were significantly different in the Bioactive glass samples, while zinc oxide nanowire showed stable pH. Antibacterial activity against *S.mutans* was significant lower for 45S5 at 50 mg/ml, 45S5F and zinc oxide nanowire in all concentrations at 24 h. While in 48 h, 45S5, 45S5F and zinc oxide nanowire showed significant antibacterial activity in all concentration except 45S5F at 10 mg/ml. Antibacterial activity against *S.sanguinis* was significant for 45S5 and 45S5F at 20 and 50 mg/ml and zinc oxide nanowire in all concentration at 48h. It can be concluded that Bioactive glasses (45S5 and 45S5F) exhibited antibacterial properties and pH changes depending on its concentration, while zinc oxide nanowire exhibited antibacterial properties at low concentrations with a constant pH value.**12.Paper ID: 27****Title:** Comparison of Three Commercial Latex and Non-Latex Orthodontic Elastic Bands**Authors:** Sasatarn Malanont, Surachai Dechkunakorn, Niwat Anuwongnukroh, Wassana Wichai**Abstract:** Orthodontic elastic bands are commonly made from natural rubber because they provide high resiliency at a reasonable cost. However, hypersensitivity related to protein present in latex have been reported in some patients which has led to increased usage of non-latex elastic alternatives. Therefore, the assessment of their mechanical properties is of importance. The objective of this study was to compare the physical and mechanical properties of three commercial latex and non-latex type orthodontic elastic bands. Samples of latex and non-latex type orthodontic elastics from manufacturers – AO (6.5oz), MASEL (6.0oz), GAC (6.0oz), with 3/16-inch diameter were selected. Firstly, the physical characteristics (width, cross-sectional thickness, and inner diameter) of the elastic bands were determined, following which their mechanical properties [initial extension force (F_0), 24 h- residual force (F_{24}), percentage of force decay, force exerted at 3 times the inner diameter ($F_{3 \times ID}$) and breaking force] were tested. The data were analyzed with Mann-Whitney U test and multiple comparisons among the groups were done with Kruskal-Wallis Test ($p < 0.05$). Significant differences were found in the physical characteristics and mechanical properties among each brand and type of elastics. AO



elastic bands had significantly low F_0 and F_{24} compared with the others. While the percentage of force decay at 24 h was greatest in AO followed by MASEL and GAC. Non-latex type elastics showed greater force decay than latex type ones, approximately 30-40% and 20-30% of the initial force in non-latex and latex type elastic, respectively. AO elastics showed the highest $F_{3 \times ID}$ and also the lowest breaking force. Overall, non-latex type elastics exhibited lower breaking force compared to latex type ones. Wide variations were observed in the physical and mechanical characteristics among same manufacturer and same elastic type. All commercial brands presented higher $F_{3 \times ID}$ than that stated by the manufacturers. Non-latex type elastics showed greater force decay over 24 h than latex type ones. The differences in the properties between the 2 types of the elastics could be due to the differences in their structure and polymers composition.

13.Paper ID: 65

Title: Highly increased flow-induced voltage generation on hybrid membranes of monolayer graphene and single-walled carbon nanotubes

Authors: Jungryung Chae, Chanyong Shul, and Wonsuk Jung

Abstract: We investigate the hybrid structure composed of single-walled carbon nanotubes (SWCNTs) and monolayer graphene to highly increase flow-induced voltage generation by an ionic droplet on these hybrid carbon membranes. These properties were characterized by Raman spectra, a field-emission-scanning probe, and optical microscope. We demonstrated flow-induced voltage generation on the hybrid structure at various ion concentrations of NaCl. The generated voltage for the membrane of SWCNTs/graphene/SWCNTs was 8.636 and 4.92 times larger than for the SWCNTs, and graphene/SWCNTs membranes, respectively, based on the highly increased electron dragging mechanism.

Session 2**April 19, 2019 (15:40-17:00)****1.Paper ID:60**

Title: Observation of Tribological Fatigue Fracture on PEEK Shaft with Artificial Defect under One-point Rolling Contact by using 2.5D Layer Method

Authors: Hitonobu KOIKE, Shuta YAMADA, Gang DENG, Koshiro MIZOBE, Takuto YAMADA and Katsuyuki KIDA

Abstract: In order to explore the mechanism of tribological fatigue fracture in PEEK (Poly-ether- ether-ketone) polymer mechanical element application, one-point contact type RCF (rolling contact fatigue) tests were carried out by using a PEEK shaft with an artificial defect. An alumina ball contacted a PEEK shaft specimen under maximum Hertzian stress 380 MPa. Flaking and internal fatigue crack propagation under the rolling track of the tested PEEK shaft were investigated through 2.5D layer observation method. The main fatigue crack occurred near the artificial defect on the rolling track of the PEEK shaft, and propagated into depth direction. In addition, the main fatigue crack branched due to internal shear stress. The branching crack as internal fatigue crack propagated into the ball's rolling direction. After the linkage of the branching crack and another



semicircular surface crack, the horseshoe-shaped flaking as tribological fatigue fracture occurred on the rolling track of the PEEK shaft.

2.Paper ID: 61

Title: Supercritical fluid-assisted dispersion of C.I. Pigment Yellow 139 in an organic medium

Authors: Hsien-Tsung Wu, Sih-Hao Huang, Po-Hsiang Chang

Abstract: In this study, a dispersion of 2 wt.% C.I. Pigment Yellow 139 particles in propylene glycol monomethyl ether acetate (PGMEA) using a supercritical fluid-assisted dispersion (SFAD) process was investigated. The favorable formulation of the dispersants is a blend of 40% PS3 + 5% FSO + 50% water (based on the weight of the pigment) in the PGMEA medium. Maintaining the SFAD process at a supercritical state improves the dispersion. Under the favorable conditions, i.e., 328.2 K and 25 MPa, the mean size of the pigment dispersoid with blended dispersants in PGMEA is as small as 182 nm, which meets the required range of less than 200 nm in industrial applications. The transmittances, color analyses, and TEM images of the pigment dispersoids prove that the SFAD process can disperse pigment particles in PGMEA.

3.Paper ID: 63

Title: Investigating the Influence of Wick Structure Materials on Active Loop Heat

Authors: Schen-Chun Wu, Yan-chun Chen, Zhan-Hui. Lin, Chun-Ko Lo, Wei-Jie Hsu, Chien-Chun Kung

Abstract: The traditional loop heat pipe (TLHP) is a passive two-phase flow heat dissipation system, which is one of the research priorities in the latest heat dissipation components, and the wick structure is the core of its system. However, TLHP generates heat leakage easily at high power density, which causes the evaporator to dry out and affect its performance. Therefore, it is generally recommended to use a PTFE wick structure with a low thermal conductivity, and a metal wick structure such as copper or nickel is the second choice.

This paper aims to add the pump into the active loop heat pipe (ALHP), and to improve the performance of the problems above. In terms of the wick structure materials of ALHP, the priority recommendation has not been ascertained, so the purpose of this paper is to find out the performance and potential of ALHP, and to further understand the influence of wick structure materials on the ALHP. The experimental results show that the performance of ALHP is more than 2 times compared to TLHP, which has the potential to solve the demand of higher power density. The wick structure is different from TLHP, nickel and copper capillary structure are more suitable than PTFE wick

4.Paper ID: 29

Title: Effect of frequency to Ultrasonic Vibration-assisted Wire-EDM

Authors: Patittar Nakwong, Apiwat Muttamara

Abstract: Wire electrical discharge machine (WEDM) is non-conventional machining process. It can be used for hard cutting material. The study has been presented the combining WEDM with an ultrasonic machine (USM) with brass and tungsten were used as a wire electrode and workpiece respectively. The experiment was carried out with an ultrasonic transducer at 40, 80 kHz. The results were observed with the material removal

rate (MRR) and surface roughness (Ra). This research introduced the method of USM setup and described the effect of vibration with the wire electrode on the displacement of amplitude. The result shows that the WEDM process with USM at 40 kHz can be more improved with the material removal rate and surface roughness than that of USM at 80 kHz. This can be explained that higher frequency affected to vibration displacement which makes lower amplitude.

5.Paper ID: AM938

Title: Failure observation of 3D-printed thrust bearing specimens with inner defects in water conditions

Authors: Koshiro Mizobe, Tatsuki Atsumi and Katsuyuki KIDA

Abstract: Additive manufacturing (AM) methods are developing and have become popular, but questions remain about the strength of parts made by this method. We have already investigated the effect of the lamination direction on the fractures in bearing specimens. In this study, we made inner defects in the 3D-printed bearing specimens and performed rolling contact fatigue (RCF) tests on this specimens immersed in a water bath in order to investigate the fracture of 3D printed bearings.

6.Paper ID: AM939

Title: Subsurface stress distribution and failure of PPS thrust bearings under rolling contact fatigue in water

Authors: Xiaochen Shi, Akihiro Adachi and Katsuyuki Kida

Abstract: In recent years, environments of bearings and polymer materials have been more and more attractive due to several advantages against ordinary metal material. However, there is still room for the further study about strength of polymer bearings. One of questions is the mechanism of fatigue crack propagation, which is the main cause of the damage of polymer bearings under rolling contact with lubricant, like water. In this study, subsurface stress distribution and failure of PPS thrust bearings under rolling contact fatigue in water are discussed to understand the detail of the crack propagation.

7.Paper ID: AM940

Title: Observation of crack growth behavior of 400 μ m cracks in 4.762mm silicon nitride balls under cyclic compressive load

Authors: Takumi TORIKI, Tomoya MATSUI and Katsuyuki KIDA

Abstract: In order to investigate the effect of pre-crack lengths on silicon nitride balls under cyclic pressure loads, the pre-crack lengths ranging from 400 μ m to 500 μ m were observed. Their growth behavior was compared to that of 200 μ m to 300 μ m pre-cracks. Furthermore, the initial threshold limits of their maximum stress intensity factors were measured.

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Thanks again for all your great attention and kind support to ICAMEM2019

Thank you for all of your contributions!