The Golden Academy Conference Series

2022 Symposium for the Promotion of Applied Research Collaboration in Asia (SPARCA 2022)

Feb 25 - Feb 28 2022

Conference Proceedings

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ASIA PACIFIC SOCIETY FOR MATERIALS RESEARCH

GOLDEN ACADEMY

Message from the organizers

Dear Colleagues and Friends,

We would like to invite all of you to join the 2022 Symposium for the Promotion of Applied Research Collaboration in Asia (SPARCA 2022), which will be held during Feb 25-Feb 28 2022.

The conference is intended to serve as an interdisciplinary platform for the exchange and networking between top scientists, experienced engineers, frontier researchers, and students across a wide spectrum of research fields.

Your active participation and discussion is the key to the success of this conference.

Yours Sincerely,

SPARCA 2022 Committee
Asia Pacific Society for Materials Science (APSMR)
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Conference topics

1. Structure materials and Functional Coatings (metals, ceramics, and composites)

2. Materials for energy (saving, conversion, transfer, storage) and environment plus electrochemistry

- ***2.1. Photovoltaics***
- ***2.2. Batteries and Fuel Cells***
- ***2.3. Materials for Thermal Management and Thermal Energy Utilization***
- ***2.4. Materials for Energy and Environmental Applications***

3. Optics and Photonic Materials

4. Electronic, Magnetic and Nanomaterials

5. Polymer Science and Molecular Chemistry

6. Organic Materials and Bio-materials

7. Materials Characterization and Computational Modeling

Beijing/Singapore /Taipei /Hong Kong	Tokyo/Seoul	FRI, 02/25	SAT, 02/26	SUN, 02/27	MON, 02/28
9:30-12:00	10:30-13:00		Oral Presentation		
12:00-13:00	13:00-14:00	Lunch Break			
13:00-16:00	14:00-17:00	Oral Presentation			

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Presentation List

Beijing/Singapore /Taipei /Hong Kong	Tokyo/Seoul	FRI, 02/25	SAT, 02/26	SUN, 02/27	MON, 02/28
9:30-12:00	10:30-13:00		7. Q.H. YU 8. R.T. WU 9. Z.L. WU 10. K.L. FENG 11. Y. CHAI	12. Y.K. KIM 13. D.S. KIM 14. J.W. PARK 15. K.I. LEE 16. Z.H. XIE	17. K. KAWAKAMI 18. M.B.A. RAHMAN 19. S. MATSUMOTO 20. S.C. HSU 21. K.B. ZHENG
12:00-13:00	13:00-14:00	Lunch Break			
13:00-16:00	14:00-17:00	1. K. YAMAMOTO 2. Y.K SHEN 3. K. SIM 4. C.G. KIM 5. S. NAKASHIMA 6. X.L. WANG			

GOLDEN ACADEMY

FRIDAY 02/25

1. Development of gasoline particulate filter by SiC sponge (K. YAMAMOTO)
2. The characterization of biopolymers scaffolds by 3D bioprinting applied on bone graft substitute (Y.K. SHEN)
3. Elastomeric materials based soft electronics enabling wearable and bio-implantable devices (K. SIM)
4. Magnetoresistive sensors with high resolution and thermal stability for versatile healthcare and microelectronics industries (C.G. KIM)
5. Thin film fabrication using mists containing semiconductor nanoparticles for gas sensing application (S. NAKASHIMA)
6. Preparation and investigation of diamond-incorporated copper coatings on a brass substrate by composite electrodeposition (X.L. WANG)

SATURDAY 02/26

7. Preparation of Al2O3/Y2O3 composite coating for deuterium permeation reduction (Q.H. YU)
8. On the interfacial stability of thermal barrier coatings (R.T. WU)
9. Oxidation behavior of Si- rich Mo-Si-B coating doped with La by spark plasma sintering (Z.L. WU)

10. Cyclic oxidation behavior of aluminide coating on new Cobalt-based γ / γ' superalloy (K.L. FENG)
11. TBA (Y. CHAI)

SUNDAY 02/27

12. Design of selective chemical reaction in liquid crystals via organic ionics (Y.K. KIM)
13. Micro-actuator mimicking pollen grain using liquid crystal network (D.S. KIM)
14. Investigation on the behavior of the cinnamycin for the biomimetic membranes (J.W. PARK)
15. On the Mechanisms and Mitigation of Volcanic Ash Attack on YSZ Thermal Barrier Coatings (K.I. LEE)
16. TBA (Z.H. XIE)

MONDAY 02/28

17. Regulation of nonequilibrium dynamics of pharmaceutical glass to assure its storage stability and dissolution performance (K. KAWAKAMI)
18. Targeted anticancer drugs nanohubs for pulmonary delivery (M.B.A. RAHMAN)
19. Relationship between electric conductivity, halogen-halogen interaction, and HOMO energy in iodinated thiazolo[2,3-a]isoquinolinum salts (S. MATSUMOTO)

20. Rapid detection of glucose on nanostructured gold film biosensor by surface-enhanced raman spectroscopy (S.C. HSU)
21. TBA (K.B. ZHENG)

Conference Presentation Abstracts

GOLDEN ACADEMY

Fri/02/25

Abstract ID: 1

Development of gasoline particulate filter by SiC sponge

Kazuhiro YAMAMOTO, Nagoya University, Japan

Due to their fuel economy, gasoline direct injection (GDI) vehicles are expanding their share of the market. However, different from traditional port fuel injection (PFI) gasoline vehicles, GDI engines emit more particulate matters (PMs). By considering that more stringent regulation is setting in the world for gasoline vehicles, a filter for gasoline soot is necessary even in Japan, which is called a gasoline particulate filter (GPF). However, as mass of deposited soot is increased, the pressure drop across the filter wall is enlarged, resulting in a decrease in engine output and a subsequent worsening of fuel efficiency. To avoid this situation, we need to produce the filter which has the lower pressure drop. Hence, the prior filter design is needed for optimizing the filter substrate structure such as pore size and porosity for the reduction of filter backpressure.

In this presentation, our numerical approach is firstly introduced. We have simulated the flow in DPF by a lattice Boltzmann method (LBM) [1-6]. The structure of the real cordierite filter is scanned by a 3D X-ray CT technique. By our proposed tomography-assisted simulation, it is possible to discuss the local velocity and the pressure variation due to the soot deposition inside the filter, which is hardly obtained by experiments. As one example of the simulation, SiC sponges with porous material are introduced, which can be potentially applied for GPF. Here, effects of the filtration velocity and the soot size have been investigated. The pressure drop is discussed by visualizing the flow and soot deposition region inside the sponge, so that the real flow field can be simulated inside the filter wall. The complex flow pattern is formed even in the relatively large pore of the sponge.

Notes

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Fri/02/25

Abstract ID: 2

The characterization of biopolymers scaffolds by 3D bioprinting applied on bone graft substitute

Yung Kang SHEN, Taufik Abdullah MAPPA, Keng-Liang OU, Taipei Medical University, Taiwan

Tissue engineering will provide a solution to meet the growing needs for bone substitutes. Among the potential solutions, 3D bioprinting is a promising method to fabricate functional bone substitutes especially for the treatment of complex and critical-sized bone defects with the use of some biopolymers like as bio-ink according to the rheological property and cell viability. Sodium alginate 6% and gelatine 1% were mixed with various concentrations (6%, 8%, and 10%) of Pluronic F-127, which denoted as AGF 6%, AGF 8% and AGF 10%. The wettability of AGF was assessed through contact angle measurement. AGF were characterized in terms rheological and printability properties. Subsequently, AGF with the proper content was subjected to performed cell viability assay. The obtained results indicated the AGF 6% sample exhibited the lowest loss rate of contact angle, acceptable rheological variation, superior printability, and good biocompatibility. Therefore, the AGF 6% sample could be developed as potential bio-ink for 3D bioprinting applications. This aimed of the present study was to investigated the characterization of biopolymers scaffolds using 3D bioprinting for bone graft substitute.

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Fri/02/25

Abstract ID: 3

Elastomeric materials based soft electronics enabling wearable and bio-implantable devices

Kyoseung SIM, Ulsan National Institute of Science and Technology, Korea

Over the past few decades, the significant development of technology for electronic devices has improved the quality of life, including living standards, healthcare, security, etc. However, conventional wafer-based electronics limit the innovation of advanced wearable electronics due to a mechanical mismatch between the device's rigid/flat properties and soft/curvilinear characteristics of humans. Therefore, soft electronic devices with excellent performance are necessary to achieve the various innovative technologies because of their softness that makes seamless contact with the human body and maintains the device properties even under high mechanical deformation. This talk will introduce high-performance fully soft electronic devices made by only elastomeric composites with rubber-like mechanical properties rather than utilizing structural engineering that has many drawbacks. In this research, the semiconductor, electrodes, and gate dielectrics are prepared by composites based on poly(3-hexylthiophene) nanofibril/elastomer, networked silver nanowire/polydimethylsiloxane, and porous structured polymeric matrix/ionic liquid, respectively. A high conductive metallic carbon nanotube was introduced into the semiconducting layer to provide fast paths for charge carriers, which achieve high mobility soft field-effect transistor with no significant property loss under the mechanical strain of 50%. In addition, soft logic gates, sensory skin, and implantable electronics were successfully demonstrated as promising future applications such as wearable and bio-implantable devices. The softness of the device allows it to operate reliably on human skin and inside the body.

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Fri/02/25

Abstract ID: 4

Magnetoresistive sensors with high resolution and thermal stability for versatile healthcare and microelectronics industries

Byungwha LIM, Taehyung JEON, Mijin KIM, Changyeop JEON, Proloy T. DAS, CheolGi KIM,
Daegu Gyeongbuk Institute of Science and Technology, Korea

Advancements in micro and nanotechnology lead to rapid employment of thin film based magnetoresistive (MR) sensors in both healthcare and emerging microelectronics industries. Here MR sensors as “bio-convergence devices”, is ranging from bio-chemical diagnosis to physico-mechanical analysis of vital signals. Secondly, MR sensors are required for the several industrial domains covering aeronautics, magnetic flux leakage, environment, Internet of Things (IoT), mobile. The developments in recent years have witnessed an upsurge in the use the MR sensors with new technological improvements to fulfill the high sensitivity and thermal stability. Even though the planar Hall Magnetoresistance (PHMR) sensor in NiFe/IrMn and NiFe/Cu/IrMn on Si/SiO2 substrate exhibits an excellent field sensitivity, thermal stability, and linearity with +/- polarity near zero field, its characteristics are underestimated compared with the conventional AMR/GMR/TMR sensors.

One of specific features of PHMR sensor is thermal stability, that is, low thermal drift of sensor junction. Basically the resistance of AMR and PHR geometries is ~ 5 and 0.1 , respectively, causing that thermal noise of PHR junction is 2 order lower than AMR. Moreover, because the thermal drift in each arms are compensated in ring type junction as in Figure 1, the resistance variation with temperature, R/ T was measured to be 0.02 , of which value is ~ 100 times less than AMR junction (~15). Another specific feature is the tunable field sensitivity by adjusting exchange coupling field using the nonmagnetic Cu layer between NiFe and IrMn, and the ring number, from ~ a few μV/Oe for cross type to 2 mV/Oe for 7 ring sensor [1]. In this talk, I will summarize the speci,fic features of PHMR junctions and robust on-chip magnetometry applications in harsh environments.

[1] Planar Hall Resistance Sensor With Improved Thermal Stability, Taehyeong Jeon et al., IEEE MAGNETICS LETTERS, Volume 10 (2019) 8.

Notes

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Fri/02/25

Abstract ID: 5

Thin film fabrication using mists containing semiconductor nanoparticles for gas sensing application

Shintaro NAKASHIMA, Mitsuhiro HONDA, Yo ICHIKAWA, Nagoya Institute of Technology, Japan

Gas sensing has greatly contributed to safety control in factories and households. Semiconductor thin films are attracting attention as a sensing material owing to their potential for miniaturization and enhanced sensing performance. To further improve the performance of semiconductor gas sensing, it is important to control the surface of the thin film in terms of reactivity and the reaction area. We developed a green and economical approach to fabricate thin films with mists that containing already-prepared semiconducting nanoparticles (NPs). In this method, the dispersion of NPs is misted by ultrasonic waves and the generated mists are sprayed onto the substrate surface using a carrier gas to produce a thin film. In this study, SnO2 NPs were used as the oxide semiconductor nanoparticles due to the sensitivity to various oxidizing and reducing gases, as well as inexpensive, and stable characteristics. It is found that the control in the flow rate of mists allows for fabricating a densely packed and uniform film of SnO2. When such films are applied for gas sensing with ethanol, the higher sensitivity was found compared to prepared via the conventional method, that being simple drop-casting of dispersed nanoparticles. The approach presented in this study will be applicable for fabricating various types of semiconductor-based devices for photonic and optoelectronic applications, which could contribute to the realization of a sustainable society.

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Fri/02/25

Abstract ID: 6

Preparation and investigation of diamond-incorporated copper coatings on a brass substrate by composite electrodeposition

Xiaoli WANG, Jiangsu Ocean University, China; Chau-Chang CHOU, National Taiwan Ocean University; Jyh-Wei LEE, Ming Chi University of Technology, Taiwan; Rudder WU, National Institute for Materials Science, Japan; Hong-Yi CHANG, National Taiwan Ocean University, Taiwan

In the electrical discharge machining (EDM) process, the brass electrode has good stability and easy to machine, but with high loss rate. To reduce the electrode's wear rate and improve its service life, this work investigated an electrode coating technique by using electrodeposition method to deposit multilayers films on a brass substrate, which comprised of a Cu interlayer, a co-deposited copper and diamond layer, and a Cu outmost layer to fix the protruding diamond particles. The diamond powder of 2-4 m diameter was used in the study. The implementation of this EDM electrode could also effectively improve the dimensional accuracy and surface roughness of the machined workpiece. The surface morphology of the diamond-incorporated copper coatings were studied by scanning electron microscopy. The roughness of the composite coatings was investigated by an optical profiler. The surface composition and phase composition were analyzed by energy dispersive X-Ray spectroscopy and X-ray diffraction. The coatings' adhesion and wear resistance were evaluated by scratch tests. The anti-corrosion capability was summarized by Tafel curves and electrochemical impedance spectroscopy. The results showed that the diamond-incorporated copper coatings with higher diamond content had better adhesion strength and anti-wear capability. The addition of diamond particles also significantly enhanced the corrosion resistance and the potential to reduce the loss rate of the brass electrode. The optimized deposition process to obtain the mentioned performance were proposed and addressed. In contrast to common high temperature-high pressure methods, electrodeposition could offer a more economically alternative to prepare composite coatings.

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Sat/02/26

Abstract ID: 7

Preparation of Al2O3/Y2O3 composite coating for deuterium permeation reduction

Qinghe YU, Weijing WANG, Kezhi HUANG, Jing MI, Lei HAO, GRIMAT Engineering Institute CO., LTD., China

The Al2O3/Y2O3 composite ceramic coating was prepared on the surface of 316L stainless steel by the radio frequency magnetron sputtering method, and its resistance to deuterium permeation was studied. The SEM, TEM, XRD and AES were adopted in order to analyze the microscopic morphology, phase composition and element distribution of the sample. The results show that the Al2O3/Y2O3 composite coating is densely deposited, and the interface between the coatings is clear and smooth. The total thickness of coating is 340 nm. After annealing at 973 K, the coating is composed of amorphous Al2O3 and cubic Y2O3, and three elements of Al, Y and O are uniformly distributed in the direction perpendicular to the substrate. The deuterium permeation performance of the coating was measured by the gas-phase permeation method. In the temperature range of 873 K-973 K, the presence of the coating can reduce the deuterium permeability by 2-3 orders of magnitude compared with the substrate. Under the permeation condition of 973 K and 80 kPa, the permeation reduction factor (PRF) of the Al2O3/Y2O3 coating is 536, which is higher than that of the single-layer Al2O3 (PRF=103) and Y2O3 (PRF=256) coatings, showing good deuterium barrier properties. The research shows that the introduction of the interface and the existence of hydrogen trap at the interface for the composite coating can effectively reduce the permeation rate of deuterium and improve the deuterium barrier performance.

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Sat/02/26

Abstract ID: 8

On the interfacial stability of thermal barrier coatings

R.T. WU, XTU

Efficient energy use, sometimes simply referred to as energy-saving, involves efforts to reduce the amount of energy wasted. To minimize heat loss and improve energy utilization, materials with ultra-low thermal conductivities are becoming increasingly important under the growing demand for high performance thermal management. Thermal barrier coatings (TBCs) based on yttria stabilized zirconia are widely used in advanced aerospace applications as high temperature thermal insulation materials. In this workshop, I will be presenting my research activities on understanding the interfacial stability and factors controlling thermal, micro-mechanical and physical properties of these materials.

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GOLDEN ACADEMY

Sat/02/26

Abstract ID: 9

Oxidation behavior of Si- rich Mo-Si-B coating doped with La by spark plasma sintering

Zilong WU, Chungen ZHOU, Beihang University, China

In this study, Mo-60Si-5B coating doped with 0.5 at% La was deposited on Nb-Si based alloy by spark plasma sintering and the oxidation resistance of the coating at 1300℃ was investigated. The results show that the mass gains of 0.5La-Mo-60Si-5B and Mo-60Si-5B coatings are 0.85 mg/cm-2 and 1.02 mg/cm-2 after oxidation at 1300℃ for 100h, respectively. Good oxidation resistance of the coating is attributed to the formation of the glass phases La2SiO5 and SiO2 with low oxygen permeability, as well as the inhibition of oxygen diffusion due to the segregation of La2O3 at the grain boundary.

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Sat/02/26

Abstract ID: 10

Cyclic oxidation behavior of aluminide coating on new Cobalt-based γ / γ' superalloy

Kanglu FENG, Chungen ZHOU, Beihang University, China

The aluminide coatings were prepared on the new γ' -strengthened cobalt-based superalloy using a pack cementation method. The Al coating consists of two layers, including the outer layer and the diffusion zone, and the outer layer is mainly composed of Al13Co4 phase. Cyclic oxidation resistance of the substrate and aluminide coating are investigated at 1050 ℃. Aluminide coating has the weight loss of -4.28mg/cm2 and fails after 248 cycles, but the substrate with -14.46 mg/cm2 in weight loss fails after only 23 cycles. Aluminide coating effectively improves the cyclic oxidation resistance of cobalt-based superalloy. In the initial stage of oxidation, a dense and continuous Al2O3 oxide film is formed on the surface to protect the coating from oxidation. During the thermal cycles of heating and cooling, the Al2O3 on the coating surface begins to peeling off and reformed. At the same time, the Al element in the coating continues to diffuse into the substrate. As the number of cycles of oxidation increases, the aluminum content in the coating is too low to form a continuous protective oxide film. The oxide scale formed on the Al coating is loose, porous, and prone to peeling off, which led to the underneath Co and W to be exposed to the air and oxidized to CoWO4. The formation of CoWO4 was detrimental not only to the integrity and continuity of the alumina film, but also to the mechanical property of the coated alloy, which results in further peeling of the oxide film. Ultimately, the Al coating was subjected to damage due to the constant spallation and reformation of the oxides on the surface, and fails.

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Sat/02/26

Abstract ID: 11

TBA

Yang CHAI, The Hong Kong Polytechnic University, Hong Kong

TBA

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Sun/02/27

Abstract ID: 12

Design of selective chemical reaction in liquid crystals via organic ionics

Young-Ki KIM, Jin-Kang CHOI, Won-Sik KIM, Yena CHOI, Heyin KIM, Jun-Hyung IM, Pohang University of Science and Technology, Korea

Liquid crystals (LCs) are anisotropic fluids that have both long-range molecular ordering of crystal and fluidity of liquid. This combination of properties enables LCs to be the unique material that can sense a variety of stimuli, including nano- or molecular level events, and signal them into macroscopic optical output. The capability of LCs has provided a path to the design of promising reconfigurable materials in various field, such as display, optofluidics, and sensing. Particularly in the field of chemical sensing, however, their full potential has been hindered by their poor selectivity to a target chemical specie because only the chemical affinity between LCs and target chemicals has been considered. In this work, we propose simple and versatile design rules to control not only selectivity but also sensitivity by decorating the interface of LC films with organic ionics (OIs). We demonstrated the OI-LC sensors to selectively sense and optically report the exposure of a specific gas molecule (acetic acid) even at very low concentration (< 1 ppm). In addition, we experimentally and theoretically showed that their characteristics are precisely controllable by modulating the length of carbon chain and type of counter ion in OIs. This work was supported by the Korea National Research Foundation (NRF- 2021R1A4A1030944 & 2021R1A2C2095010).

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Sun/02/27

Abstract ID: 13

Micro-actuator mimicking pollen grain using liquid crystal network

Dae Seok KIM, Pukyong National University, Korea; Teresa LOPEZ-LEON, ESPCI Paris tech., France

Over the last decades there has been tremendous efforts to create new types of colloids and their assemblies with increasingly complex structures.[1,2] In general, colloidal particles have spherical shapes and thus only functions through highly symmetric potentials, which limits designing shape of colloids and their assembly to a simple aggregation. Thus, it has been required to develop a system to modify such a tiny spherical colloid into particular complex shape. In this presentation, we will introduce novel method to fabricate various colloids using polymerizable liquid crystal(PLC) shells and droplets. Since LCs can have various self-assembled structures depending on their phases, size, thickness, surface anchoring and elasticity, a rich of topologies can be formed in spherical confinements such as shell or bulk drop by coding particular LC fields.[3,4] Here, we have shown various PLC colloids by using the topologies as skeletal for topographical evolution through two steps, polymerization and buckling by volume contraction. The mechanism of buckling and reversible behaviors by swelling and de-swelling were studied and the topographical structures were observed using polarized optical microscopy(POM) and scanning electron microscopy(SEM).

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Sun/02/27

Abstract ID: 14

Investigation on the behavior of the cinnamycin for the biomimetic membranes

Jin-Won PARK, Yeseul PARK, Sang-Ryong LEE, Seong-Eun KIM, Seoul National University of Science and Technology, Korea

The interaction between the cinnamycin and the biomimetic membranes was studied using the atomic force microscope(AFM) and using the surface plasmon resonance(SPR). The membrane was composed of the inner layer tethered on the gold surface and the outer layer formed on the inner layer, which was at the desired ratio of dioleoylphosphatidylethanolamine (DOPE) to dioleoylphosphatidyl- choline(DOPC). The specific binding between the cinnamycin and the lipid bilayer was directly measured using the AFM and the occurrence of the binding was monitored with respect to time using SPR. Furthermore, the behavior of the cinnamycin immobilized on the gold nanorod(AuNR) was investigated for the bilayer using surface plasmon resonance(SPR) because gold nanostructures are the great candidate for therapeutic drug delivery and noninvasive disease diagnostics.

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Sun/02/27

Abstract ID: 15

On the Mechanisms and Mitigation of Volcanic Ash Attack on YSZ Thermal Barrier Coatings

Kuan-I LEE, National Institute for Materials Science, Japan

Yttria stabilized zirconia (YSZ) made thermal barrier coatings (TBCs) have been widely applied to aero engines for decades. When engines are in operation, airborne particles, dusts and ashes could be injected into engine, which then melt and deposit on turbine blades, forming calcium-magnesium-alumino-silicate (CMAS). Molten CMAS penetrates into TBCs, both chemically and mechanically damaging the integrity of the YSZ top coat. For the modern TBC technology, two major techniques have been developed to mitigate the CMAS attack: 1) modifying the YSZ topcoat chemistry by elemental doping, 2) preparing a protective overlay on top of YSZ top coat. With these two techniques, alumina is the most common material chosen to prevent CMAS attack. In this research, real volcanic ash was utilized to study the degradation process of TBCs and potential mitigation mechanisms.

Our results showed that similar to CMAS, volcanic ash penetrates severely through the thickness and fills up the columnar gaps of TBC top coat. The results also found that yttria content of the YSZ top coat decreases substantially upon high temperature exposure to volcanic ash, which has detrimental implication to the phase stability of YSZ. With respective to mitigation, volcanic ash reacts with alumina around 1310°C, and forming anorthite ($CaAl_2Si_2O_8$), magnetite (Fe_3O_4), and spinel ($Al_{1.75}Mg_{0.889}Mn_{0.351}O_4$) as reaction products. According to the literature, these reaction products have melting temperatures higher than the volcanic ash and the typical CMAS. As the melting temperatures of reaction products are now above typical surface operating temperature of turbine components, melting induced penetration of volcanic ash and CMAS can be suppressed considerably.

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Sun/02/27

Abstract ID: 16

TBA

Zhihang XIE, Xiangtan University, China

TBA

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GOLDEN ACADEMY

Mon/02/28

Abstract ID: 17

Regulation of nonequilibrium dynamics of pharmaceutical glass to assure its storage stability and dissolution performance

Kohsaku KAWAKAMI, National Institute for Materials Science, Japan

Crystalline drugs are usually utilized for solid dosage forms of pharmaceutical products. However, amorphous state is sometimes utilized, because it has higher solubility relative to the crystalline state. Amorphous solids are always seeking opportunity to transform into crystals, as it has lower Gibbs energy compared to the amorphous state. Thus, deep understanding on crystallization kinetics of amorphous drug is required for assuring storage stability of the pharmaceutical glass. Meanwhile, dissolution process of pharmaceutical glass also requires attention for maximizing its ability. When amorphous solids are dissolved, supersaturated state relative to solubility of crystals are formed. Supersaturated solution may cause liquid-liquid phase separation to minimize Gibbs energy, which is a metastable state beneficial for absorption of orally administered drugs. However, once crystals appear in the solution, the supersaturated state is immediately destroyed to decrease drug concentration to solubility of the crystals. Dissolved state of drug molecules must be strategically controlled for inhibiting undesired crystallization of drugs from the solutions.

In this talk, regulation of crystallization behaviors of pharmaceutical glass both in solid state and in solutions are discussed from viewpoints to assure its storage stability and dissolution performance, respectively.

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GOLDEN ACADEMY

Mon/02/28

Abstract ID: 18

Targeted anticancer drugs nanohubs for pulmonary delivery

Mohd Basyaruddin Abdul RAHMAN, Azren Aida ASMAWI, Universiti Putra Malaysia, Malaysia

Nanocolloidals and nanomaterials with unique effects and potency are increasingly being considered for application in lung pathologies, especially lung cancer. Various anticancer drugs have been extensively investigated for their pharmacological effects on lung cancer. However, clinical applications of hydrophobic drugs are limited due to poor solubility and low stability in an aqueous medium. Nanoemulsion provides several advantages for pulmonary application and needs to be formulated using biocompatible excipients due to stability and toxicity concerns. Single and dual drugs nanoemulsion systems formulated using palm-based esters and further characterized physicochemically and aerodynamically will be discussed. Development of nanohubs from graphene, iron oxides, mesoporous silica and reticular materials were also explored. Though, when the carrier is considered as a whole system, several requirements on its aerodynamic properties should be taken into account for effective pulmonary delivery. A sustained release of drugs and their kinetics analysis suggested slow-released drugs to the targeted site at lower pH. Based on in vitro and ex vivo studies, it is interesting to relate how the nanosize may affect the nanotoxicity of the cells. Inhalation therapy of lipid-based and solid nanocarriers has a great potential indirect target towards respiratory diseases. These preliminary screening on aerosolization performance of nebulized nanohubs can possibly correlate the deposition with in vivo studies and implies that the formulations can be deposited in the deep lung region, where the tumours are normally found.

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GOLDEN ACADEMY

Mon/02/28

Abstract ID: 19

Relationship between electric conductivity, halogen-halogen interaction, and HOMO energy in iodinated thiazolo[2,3-a]isoquinolinum salts

Shoji MATSUMOTO, Chiba University, Japan

We have reported the synthesis and the crystal structures of the organic salts by the reaction of 2-(2-(phenylethynyl)phenyl)beinz[d]imidazoles with I2 to give iodinated benzimidazo[2,3-a]isoquinolinum salts bearing triiodide as a counter anion. Herein, we examined the synthesis and the crystal structure of the organic salts bearing thiazole ring by the reaction of 2-(2-(phenylethynyl)phenyl)thiazoles with I2. A six-membered ring was formed to produce the corresponding iodinated thiazolo[2,3-a]isoquinolin-7-ium salts. The counter anions (I− and I3−) varied based on the structure of the thiazole moiety. We also revealed the single-crystal X-ray structures of those salts with and without halogen bonds (categorized as Type II interaction). The compounds bearing bulky phenyl group on thiazole ring showed the Type I interaction (short contact between two halogen atoms without halogen bond) in the crystal structures although the compounds having methyl group gave the Type II interaction.

We also examined the electric conductivity of the thiazolo[2,3-a]isoquiolinium salts focused on the different halogen-halogen interaction character. Measuring the electric conductivity (σ) of the pellet by two-probe method, the electric conductivity was observed under I2 vapor conditions. Larger σ was obtained from the compounds with Type I interaction. Focused on HOMO energy, larger electric conductivity was obtained from the salts with higher HOMO energy. It would be caused that higher HOMO energy derives to easier oxidation by I2 to form hole. Higher HOMO energy was obtained by changing the interaction angles of the compounds with Type II interaction into Type I interaction. Therefore, the type of halogen-halogen interaction would be strongly influenced in their physical character. In the case of benzimidazo[2,3-a]isoquinolinum salts, smaller σ was observed under I2 vapor conditions although Type I interaction was found in its crystal structure. Thus, sulfur atom also affected the electric conductivity in isoquinolinium salts.

Notes

GOLDEN ACADEMY

Mon/02/28

Abstract ID: 20

Rapid detection of glucose on nanostructured gold film biosensor by surface-enhanced raman spectroscopy

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In this report, we summarized our development of biosensors for Rhodamine 6G and in vitro glucose detection based on surface-enhanced Raman scattering technology. For the detection of both Rhodamine 6G and in vitro glucose, a nature-patterned substrate with gold films over nanostructures (NPS-AuFON) was used as the surface-enhanced Raman scattering sensor platform. The enhancement factor was calculated at 9 × 107. In the processing of the substrate, cyclic voltammetry was used to form nano-gold particles under different conditions. The Rhodamine 6G and glucose detection were then achieved on this substrate. Furthermore, we combined the potentiostatic technique and electrochemical adsorption to best detect glucose in low concentrations. The glucose oxidation potential (100 mV) was used to capture glucose close to the surface of the NPS-AuFON. The quantitative detection of glucose in solution and in situ inspection were confirmed. Further, we determined that this surface modification technology can reach the goal of experiments set by the World Health Organization to judge whether or not a patient is a diabetic by detecting a glucose concentration of 11.1 mmol/L (mg/dL) at a minimum.

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