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Part I Conference Schedule

Time: Aug. 20-22, 2021
Location: Guilin Grand Link Hotel (桂林桂山华星酒店), China

Date	Time	Location	
Aug. 20	**14:00-17:00**	**Registration (Lobby)**	
		Location: TBD, 2nd Floor	**Location: TBD, 2nd Floor**
Aug. 21	**08:30-12:00**	**Physics Sciences:** **Keynote Speech Session I** Prof. Longjun Dong, Prof. Lu, Bing-Yuh, Dr. Mabrouk BEN TAHAR, Prof. Igor Solodov, Prof. Hussein M Elmehdi, Dr. Mohammad Khishe **Chair:** **Coffee Break: 09:50-10:10**	**Materials Sciences:** **Keynote Speech Session I** Prof. Ji Wang, Dr. Fujun Xu, Prof. Ruizhi WU, Prof. Stefano Mariani, Prof. Thomas Brown, Dr. Maciej Trejda **Chair:** **Coffee Break: 10:00-10:20**
	12:00-13:30	**Lunch** [Whisper Garden Lounge [叮咛吧] Lobby]	
	14:00-18:00	**Physics Sciences:** **Keynote Speech Session II** Dr. Jian Xie, Prof. Liwu Fan, Dr. Yan Su, Prof. Ir. Dr. Basil T. Wong, Prof. Dr. Ruijin Wang, Dr. Xinxi Li **Chair:** **Coffee Break: 16:00-16:10**	**Materials Sciences:** **Keynote Speech Session II** Prof. Laszlo S. Toth, Prof. Xiaopeng Li, Prof. BI Guijun, Dr. Mohd Afizi Mohd Shukran, Dr. Afshin Abrishamkar, Dr. Tarek Aly Elsayed **Chair:** **Coffee Break: 15:30-15:50**
	18:00-19:30	**Dinner** [Whisper Garden Lounge [叮咛吧] Lobby]	
		Location: TBD, 2nd Floor	**Location: TBD, 2nd Floor**
Aug. 22	**08:30-12:00**	**Physics Sciences:** **Keynote Speech Session III &** **Technical Session** Dr. Shuifa Shen, Dr. Nikolas Patronis, Dr. Mohamed Salem Badawi, Dr. Vladimir Kondratyev, Dr. Andrei Ivanets **Chair:** **Coffee Break: 10:30-10:40**	**Materials Sciences:** **Keynote Speech Session III &** **Technical Session** Prof. Chaozong Liu, Dr Gurumurthy Hegde, Prof. Rajiv Dutta **Chair:** **Coffee Break: 10:30-10:40**

	12:00-13:30	**Lunch** [Whisper Garden Lounge [叮咛吧] Lobby]
Aug. 23	**6:00-18:30**	**One Day Tour (on pending)**

Part II Keynote Speeches

Physics Sciences: Keynote Speech Session I

Keynote Speech 1: Some key issues of acoustic emissions and microseismic monitoring in deep rock engineering: from data to information

Speaker: Prof. Longjun Dong, School of Resources and Safety Engineering, Central South University, China
Time: 08:30-09:10, Saturday Morning, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
The microseismic/ acoustic emission (MS/AE) monitoring is an effective and widely used method for the rock stress monitoring in deep rock engineering. The MS/AE monitoring includes source localization methods, and source mechanism inversion and discrimination. In this presentation, a set of localization source methods were introduced to eliminate the effects for the location accuracy induced by premeasured P-wave velocity, straight wave path, and abnormal arrivals. Four kinds of source classification methods are proposed for solving the difficulty that the discrimination of microseismic events and blasts is totally dependent on manual classification. On the basis of the above research, full waveform inversion methods are used to investigate the different microseismic source mechanisms in a more quantitative way. This presentation provides beneficial suggestion for removing noises for MS/AE data, which provide useful information to control and prevent the disasters induced by high stress in deep rock engineering.

Index Terms: discrimination, localization methods, removing noises, moment tensor inversion, and rock engineering

Keynote Speech 2: Technical Perspectives on Distant Auscultation of Lung Sounds

Speaker: Prof. Bing-Yuh Lu, Guangdong University of Petrochemical Technology (GDUPT), China
Time: 09:10-09:50, Saturday Morning, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
This study presented the collection of the studies on lung sounds from Faculty of Automation, Guangdong University of Petrochemical Technology (GDUPT), Guangdong, China. The content includes (1) Reduction of the noise in the respiration sound recording by the optimal sampling rate of sound card: The verification by simple filters; (2) Unidirectional microphone based wireless recorder for the respiration sound; (3) Auscultation using modern mobile communication; (4) Auscultation on the ambulance: a case study of adaptive filter application for the safety of detecting lung sound on the ambulance; and (5) Reducing the ambulance siren noise for distant auscultation of the lung sound. In conclusion, the distant auscultation has realized in telecommunication and internet.

Keynote Speech 3: Acoustics of resonant defects: a new approach to highly sensitive vibration-activated imaging of damage in composite materials (Video)

Speaker: Prof. Igor Solodov, Institute for Polymer Testing, University of Stuttgart, Germany
Time: 09:50-10:30, Saturday Morning, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
The presence of a defect leads to a local decrease in rigidity for a certain mass of the material and therefore manifests in a particular characteristic frequency of the defect. A frequency match between the driving mechanical wave and this characteristic frequency provides a Local Defect Resonance (LDR) and results in efficient energy delivery to the defect. Unlike the resonance of an entire specimen, LDR identifies the damage by its resonant response clearly distinguished and independent of the rest (intact) part of the specimen. The objective of the paper is to demonstrate that the frequency- and spatially-selective activation of defects via the concept of LDR is the way to boost efficiency and sensitivity of diagnostic imaging of damage. Multiple case studies to be considered include resonant imaging of various defects in composite materials via laser vibrometry, vibro-thermosonics, and nonlinear acoustic techniques.

Keynote Speech 4: Finite element approach for aeroacoustics problems based on an Eulerian–Lagrangian description: Galbrun's equation (Video)

Speaker: Prof. Mabrouk Ben Tahar, University of Technology of Compi ègne, France
Time: 10:40-11:20, Saturday Morning, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
This presentation reviews our developments and applications of Computational AeroAcoustics (CAA) to acoustic propagation on subsonic non-potential mean flows, using a nonstandard linear wave equation, established by Galbrun in 1931 (LGE). Galbrun's equation describes exactly the same physical phenomenon such as the linearized Euler's equations (LEE) but is derived from an Eulerian–Lagrangian approach written only in term of the Lagrangian perturbation of the displacement. Th is equation has interesting properties and offers a good alternative to the Linearized Euler Equations (LEE). Indeed, only acoustic displacement is involved (even in non-homentropic cases). The equation provides exact expressions for acoustic intensity and energy. Also, the boundary conditions are easily expressed because acoustic displacement, whose normal component is continuous, appears explicitly, which avoid the use of Myers' condition. The governing equations are presented and a comparison will be made with LEE. Galbrun's equation is solved using a finite element method. However, with standard finite element, the direct displacement-based variational formulation gives some erroneous solutions. A mixed finite element (pressure-displacement), satisfying the inf-sup condition, is proposed to avoid this problem. Using the finite element method with an irregular mesh provides the flexibility for real industrial applications.

A particular issue such as the boundary conditions, impedance conditions, transparent boundary conditions in infinite domain and energy equation are discussed. In unbounded domain, an accurate and efficient modified perfectly matched layer (PML) is proposed. Lined boundary walls described by the Biot's model has been developed. A complex Laplace transform scheme is used to study the time dependent variables.

Finally, the proposed model is compared with some measured data and benchmark problems. The comparison shows a good agreement, which validates it.

Keynote Speech 5: Advances in the application of low intensity ultrasonic waves in characterizing the properties of soft heterogeneous biological systems (Video)

Speaker: Prof. Hussein M Elmehdi, University of Sharjah, United Arab Emirates
Time: 11:20-12:00, Saturday Morning, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
In this presentation, I will present our recent results on using nondestructive ultrasonic techniques to assess and predict the quality of wheat-based products using ultrasound longitudinal ultrasonic waves operated at 50 kHz. The two main parameters, which will be employed include the ultrasonic velocity and attenuation coefficients, which will be calculated from the ultrasonic profile using advanced signal processing technique. The latter is based on careful calculations of the transit time and amplitude changes of the ultrasonic signal as it traverse the investigated material. Mechanical properties of the material were calculated used established model for soft materials. In addition, results were correlated to other methods, which rely on destructive qualitative approaches. Our results allowed the characterization and assessment of the quality of the wheat-based samples based on the quality and content of proteins in the sample. Excellent agreement with other tests were found, which clearly support the implementation of ultrasound parameters are sensitive to changes in the sample structure and constituents, and therefore can be used as a tool that can be used to assess the quality of these samples.

Keynote Speech 5: The Role of Artificial Intelligence in Detecting and Controlling of Underwater Acoustic Noises (Video)

Speaker: Prof. Mohammad Khishe, Department of Electrical Engineering Imam Khomeini University of Maritime Sciences, Iran
Time: 12:00-12:40, Saturday Morning, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
The vibration of the ship's equipment and the cavitation of its propellers are the primary sources of noise production. The unique information included in the noise is utilized to identify the maritime boats in the ocean. In today's world, sonar targets are categorized based on the sound waves that emanate from them in a variety of ways. Various factors, including as climatic conditions, ambient noise, and a time-varying propagation route, all have an effect on the spectrum of the underwater sound wave that has been received. Recent years have seen the development of two categorization approaches to deal with the previously stated difficulties. The first type of approach is known as

deterministic methods, and it is based on oceanography, sonar modeling and engineering, and statistical processing, among other things. The second way is stochastic methods, which have a variety of applications, including the prediction of oceanic phenomena, the improvement of feature extraction approaches, and the introduction of innovative classification techniques. It has been demonstrated that the Artificial Intelligence (AI) scheme is the most well-known stochastic technique in use today. In contrast to other approaches, the AI method is a dependable methodology that exhibits several benefits over the others, including promising accuracy, intrinsic parallel configuration, and flexibility. Because of these advantages, artificial intelligence approaches are useful in a wide range of engineering problems, particularly in the categorization of underwater targets. Therefore, in this lecture, I will try to introduce the outstanding capability of AI-based system in detecting and controlling of underwater acoustic noises.

Physics Sciences: Keynote Speech Session II

Keynote Speech 7: Pseudo-boiling heat transfer mechanism of supercritical fluids and new non-dimensional supercritical-boiling-number SBO

Speaker: Dr. Jian Xie, North China Electric Power University, China
Time: 14:00-14:40, Saturday Afternoon, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
Supercritical fluids are frequently applied in advanced power systems. To keep the safe and high-efficiency operation of these systems, it is important to accurately predicte thermal-hydraulic performces of supercritical fluids. However, the prediction is unsatisfactory based on classical single-phase assumption for supercritical fluid. Instead, pseudo-boiling concept is introduced here. Supercritical fluid is assumed to be heterogeneous structure, including a wall-attached gas-like layer and a liquid-like fluid in tube core. A new non-dimensional supercritical-boiling-number SBO is propesed, representing the bubble expansion induced momentum force against the inertia force. The thickness of wall-attached gas-like layer increases with rising SBO number. There exsits a critical SBO to trigger orifice contraction effect, yeilding wall temperatue peak and huge pressure drop. Thus, critical SBO determines the switch from normal heat transfer (NHT) to heat transfer deterioration (HTD). According to a large quantity of database, the critical SBO is identified as 5.126×10−4, 2.018×10−4, 1.653× 10−4 and 1.358×10−4 for CO2 , H2O, R134a and R22, respectively. New correlations of heat transfer coeffients and friction factors were also proposed based on SBO, which is suitable for both NHT and HTD, behaving much better prediction accuracy than those correlations in the literature. Our work provides a new perspective of pseudo-boiling heat transfer mechanism and supports the heterogeneous structure of supercritical fluids.

Keynote Speech 8: Heat transfer enhencement in microchannel filled nanofluid by an alternating applied electric field

Speaker: Prof. Ruijin Wang, Hangzhou Dianzi University, China
Time: 14:40-15:20, Saturday Afternoon, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
The heat transfer of nanofluid is a research hotpot in recent decade. The elevation of thermal conductivity of nanofluid is attributed to added nanoparticles. Normally, Brownian motion of nanoparticles, aggregation of nanoparticles and nanolayer at interface of solid-liquid are regarded as the main mechanisms of the improvement of thermal conductivity. In addition, the convective heat transfer can be enhanced by an appled electric field due to the electrophoretic and dielectrophoretic force. Numerical simulations are carried out for heat transfers in microchannel with various electric fields arrangements. The results show that, the heat transfer effect is much better with a vertical electric field. If a sine or square wave electric field is applied, the heat transfer is increased with the frequency at lower frequency, decrease instead at higher frequency. The critical value of frequency is around 90 Hz for sine wave electric field, about 30 Hz for square wave electric field. The underlying mechanism is that, the movement of nanoparticles can not keep up with the alternation of electric field at higher frequency.

Keynote Speech 9: Characterization and screening of sugar alcohols for medium-temperature latent heat storage

Speaker: Prof. Liwu FAN, Zhejiang University, China
Time: 15:20-16:00, Saturday Afternoon, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
Thermal energy storage is a promising technology for improving the efficiency of thermal energy conversion and management systems. Towards a carbon-neutral world, the research and development of advanced thermal energy storage technology will become more important in the near future. Latent heat storage, featured by relatively high energy storage density and narrow temperature span during operation, has long been considered and practiced as a promising way to store thermal energy. Phase change materials (PCMs), which store and release latent heat upon cyclic phase transitions (mostly solid-liquid phase change), are the key to application of latent heat storage. Various materials, such as water, paraffin wax, molten salts, etc., have been utilized as PCMs over a wide range of

temperature from below zero degree Celsius to several hundreds degree of Celsius. The lack of appropriate PCMs makes latent heat storage at 100-200 degree Celsius a great challenge. Sugar alcohols, a class of polyhydric alcohols obtained from hydrogenation of sugars, have often been used as food sweeteners, and have recently been proposed as a good PCM candidate for latent heat storage over the medium-temperature range due to their high latent heat of fusion up to 340 J/g, which is comparable to water. In this work, we performed a systematic characterization of the heat storage and heat transfer properties of the available sugar alcohols (from 4-carbon to 6-carbon ones) and their eutectic mixtures upon consecutive melting-recrystallization cycles, in order to make a screening of the pure and mixture sugar alcohols for practical applications. Molecular dynamics simulations were also conducted to understand, at the atomistic scale, the effect of multiple hydroxyl groups on the thermal properties of sugar alcohols. We then pointed out the direction for future researches towards real-world application of sugar alcohols for highly efficiently latent heat storage over the medium-temperature range.

Keynote Speech 10: Non-dimensional Lattice Boltzmann Simulations for Thermal Energy Transportation in Porous Media (Video)

Speaker: Dr. Yan Su, Electromechanical Engineering in University of Macau, Macau (China)
Time: 16:10-16:50, Saturday Afternoon, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
Full system pore scale simulations of the thermal energy transport in porous mediums are challenge problems for high performance computation (HPC), because extreme large computational costs are necessary due to the multiple space and time scales. Recent mesoscopic length scale based Lattice Boltzmann Methods (LBMs) provide a powerful tool for advances of solving the multi-scale problem due to the advantage of considerably faster computational speeds comparing to conventional numerical methods, which are governed by the macroscopic length scale Navier–Stokes and thermal energy transport equations. The non-dimensional lattice Boltzamann method (NDLBM) developed from the conventional LBMs by directly applying the mesoscopic dimensionless governing parameters, which clarified the relationships between the macroscopic and mesoscopic scales. The dimensionless collision relaxation times expressed by the dimensionless governing parameters simplified the applications of the NDLBM. Key bridges between the mesoscopic and macroscopic transport are given. Parallelization NDLBM schemes for effective computation and communication for HPC are shown. The present uniform form module based NDLBM based scheme are expected to solve various coupled problems on heat transfer and thermophysics. Application examples for thermal energy transportation will be illustrated based on the recent results in various application fields, such as thermal conduction in various microscopic structures, diffusion through ventilation systems, natural convection through three dimensional fiber structures, and discontinuous phonon energy

transportation.

Keynote Speech 11: Simulations of Nanoscale Heat Conduction and Radiative Heat Transfer via Versatile Monte Carlo Method (Video)

Speaker: Dr. Basil T. Wong, Swinburne University of Technology Sarawak Campus, Malaysia
Time: 16:50-17:30, Saturday Afternoon, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
With tremendous advances in nanoscience, nanoscale engineering applications are bound to be more common, complex, and challenging. Further understanding of thermal transport down to nanometer scales will be crucial for the design and operation of new devices. The focus of this keynote is on thermal transport modeling at time and length scales ranging from micro- to nanoscale levels. At macro scales, the rate of heat conducted through an area is proportional to the thermal conductivity and the temperature gradient, following the Fourier law. The basic premise of the law is that the characteristic length of the object must be greater than the mean free path of the heat carriers. However, when the characteristic length of an object is smaller than the mean free path, which is commonly observed at nanoscales, heat conduction no longer obeys the Fourier law, mainly due to the impact of ballistic propagation by the heat carriers. At such scales, thermal conductivity and temperature gradient are reduced while discontinuity in the temperature distribution near the boundary exists. This requires solving of the Boltzmann Transport Equation (BTE) for phonon transport, which is an intergo-differential equation and analytical/numerical solutions are hard to obtain without elaborated assumptions. Fortunately, this can be remedied with the use of Monte Carlo simulation. In this talk, we will discuss modelling of nanoscale phonon transport within silicon structures using the Monte Carlo simulation and its applications in the thermal energy conversion. Since the Radiative Transfer Equation (RTE) is also derived from the Boltzmann Transport Equation, the developed Monte Carlo simulation for the phonon BTE can also be applied to solve the RTE with some minor modifications. This is a “double-edged sword” that one can develop while solving two transport phenomena using a similar approach.

Keynote Speech 12: Experimental investigation on the thermal performance of serpentine tube assisted silicone-based phase change materials for battery thermal management

Speaker: Prof. Xinxi Li, Guangdong University of Technology, China
Time: 17:30-18:10, Saturday Afternoon, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
As an advanced cooling method for battery m odule, phase change materials (PCM) are highly desirable but remains significant challenges, which is constrained by some problems such as easily leakage, low thermal conductivity and complex assembly process. Herein, an innovative and facile silicone based composite PCM (PCBS) has been proposed and applied in battery thermal management, which exhibits outstanding anti-leakage, perfect flexibility and excellent waterproof performances. Pouring process results in a low interface thermal resistance between PCM and battery and PCM exhibits a quicker thermal response. Coupled with serpentine tube, the constructed battery management (BMS) system displays an excellent thermal management effect. The maximum temperature of the central cell in the battery module could be controlled below 55 ℃ at 1 C discharge rate, which is 10.2 ℃ lower than that without PCBS. Considering these prominent performances, the PCBS and corresponding BMS for battery module would provide insights into the energy storage and other fields.
Keywords: Phase change material; liquid-cooling; coupled thermal management; controlling strategy; silicone gel

Physics Sciences: Keynote Speech Session III

Keynote Speech 13: High-spin states and level structure in 80Rb and 84Rb

Speaker: Prof. Shuifa Shen, Institute of Nuclear Energy Safety Technology, CAS, China
Time: 08:30-09:10, Sunday Morning, Aug. 22, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
High-spin states of 80Rb are studied via the fusion-evaporation reactions 65Cu+19F, 66Zn+18O, and 68Zn+16O with the beam energies of 75 MeV, 76 MeV, and 80 MeV, respectively. Twenty-three states with twenty-eight γ transitions are added to the

previously proposed level scheme, where the second negative-parity band is significantly pushed up to spins of 22− and 15− and two sidebands are built on the known first negative-parity band. Two successive band crossings with frequencies 0.51 MeV and 0.61 MeV in the α =0 branch as well as another one in the α=1 branch of the second negative-parity band are observed. Signature inversions occur in the positive-parity and first negative-parity bands at the spins of 11 and 16 , respectively. The signature splitting is seen obviously in the second negative-parity band, but the signature inversion is not observed. It is also found that the structure of the two negative-parity bands is similar to that of its isotone 82Y. Signature inversion in the positive parity yrast band with configuration πg9/2×νg9/2 in this nucleus is discussed using the projected shell model. High-spin states in 84Rb have been studied by using the 70Zn(18O,p3n)84Rb reaction at beam energy of 75 MeV. The γ-γ coincidence, excitation function, and ratios for directional correlation of oriented states were determined. A new level scheme was established in which the positive- and negative-parity bands have been extended up to 17+ and 17- with an excitation energy of about 7 MeV. The signature splitting and signature inversion of the positive-parity yrast band were observed. To understand the microscopic origin of the signature inversion in the yrast positive-parity bands of doubly odd Rb nuclei, as an example, we performed calculations using the projected shell model to describe the energy spectra in 84Rb. It can be seen that the main features are reproduced in the calculations. This analysis shows that the signature splitting, especially its inversion, can be reproduced by varying only the γ deformation with increasing spin. To research the deformation of 84Rb carefully, we calculate the total Routhian surfaces of positive-parity yrast states by the cranking shell model formalism. In addition, the results of theoretical calculations about the negative-parity yrast band in 84Rb with configuration π(p3/2, f5/2)×υ9/2 are compared with experimental data, and a band diagram calculated for this band is also shown to extract physics from the numerical results.

Keynote Speech 14: The application of the activation technique within the technological advances (Video)

Speaker: Prof. Nikolas Patronis, Department of Physics University of Ioannina, Greece
Time: 09:10-09:50, Sunday Morning, Aug. 22, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
Activation technique is a sensitive and accurate analytical method widely applied in nuclear physics resea rch [1]. Within the present work the activation technique was utilized for fundamental research purposes and, specifically, for cross section measurements of medium-to-heavy mass isotopes in the energy region 10-20 MeV. In particular, the cross section of the (n,2n) reaction channel for the 156Dy and 165Ho isotopes was measured. The corresponding irradiations were peformed in the 5.5 MV Tandem Van de Graaff accelerator of the Institute of Nuclear and Particle Physics at the National Center for Scientific

Research, “Demokritos”, Greece. The irradiations were followed by the induced activity measurements through γ-spectroscopy using HPGe detectors.
During the data analysis the performance of Monte Carlo simulations through the GEANT4 toolkit [2] was proved a vital tool for the extraction of important parameters. In particular, the GEANT4 simulations were performed for the purposes of simulating the efficiency of the detectors for the decay energies of the product-nuclei taking into account the self-attenuation phenomenon and the coincidence summing effect [3,4]. In addition an innovative method for the extraction of the counting peak integral of photopeaks contaminated with Ge X-ray escape peaks though the GEANT4 reproduction of the pulse heigh spectrum is discussed and presented [5].
Towards this direction, the application of the activation technique taking into advantage the technological advances, and specifically, the simulation codes, is discussed in the context of the study of challenging physics cases and the adoption of challenging experimental set-ups.

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Keynote Speech 15: The Geometry Effect of the Source-to-detector Space on Calculation of Coincidence Summing Factors in Gamma-Ray Spectrometry Field (Video)

Speaker: Prof. Mohamed Salem Badawi, Faculty of Science, Beirut Arab University, Lebanon
Time: 09:50-10:30, Sunday Morning, Aug. 22, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract

In gamma-ray spectrometry, the coincidence summing problem is considered to be one of the most problems, which affects the detector efficiency calculations. These phenomena will lead to non-negligible errors in the sample activity determination as well. The problem can appear clearly when the sources or samples which contain multi-line radioactive isotopes such as, 60Co, 133Ba, and 152Eu were measured at a close distance from the detector active part. In this work, the calculated total and full-energy peak efficiency of gamma-ray spectrometry for using different radioactive sources, in addition to the nuclear data of the radioactive decay scheme were used to estimate the gamma-gamma coincidence summing factors. The calculations were based on the numerical simulation method (NSM), which meanly used the effective solid angle due to the source-to-detector separation distance. The outcome results for the coincidence summing factors were compared with those that came out from ETNA and EFFTRAN programs CS as well. The results show a good agreement, especially at close source-to-detector distances.

Keywords: Geometry Effect, Gamma-Gamma Coincidence Summing (CS), γ-ray Detectors, and Numerical Simulation Method (NSM).

Keynote Speech 16: Properties and transmutation of magnetized heavy nuclei

(Video)

Speaker: Prof. Vladimir Kondratyev, Bogoliubov Laboratory of Theoretical Physics, JINR, & Dubna State University, Russia
Time: 10:40-11:20, Sunday Morning, Aug. 22, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
The properties, mass distribution and transmutation of atomic nuclei at strong magnetization arising during heavy ions collisions, type II supernova explosions, neutron star mergers, and in magnetar crusts are considered. For a magnetic field strength range of 0.1 — 10 teratesla the Zeeman effect results in a linear nuclear magnetic response, which can be described by making use of magnetic susceptibility [1]. Accordingly, the binding energies increase for nuclei with an open shell and decrease for nuclei with a closed shell. Noticeable enhancement of a yield of corresponding explosive nucleosynthesis products with anti-magic numbers is predicted for nuclei of the iron group and the r-process. The magnetic enrichment of the 44Ti isotope volume is consistent with the results of direct observations and indicates a significant increase in the fraction of the main titanium isotope 48Ti in the chemical composition of galaxies. Magnetic effects in neutron gamma-capture reactions are analysed. An increase in a volume of nuclides with low mass numbers at the peak of the r-process is predicted to occur due to magnetization.

Keynote Speech 17: Calcium magnesium zirconium phosphate: From adsorption to radioactive wastes disposal (Video)

Speaker: Dr. Andrei Ivanets, National Academy of Sciences of Belarus, Belarus
Time: 11:20-12:00, Sunday Morning, Aug. 22, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract

An important part of the work of nuclear power plants and other nuclear industry enterprises is the processing of liquid radioactive waste (LRW), in particular, their minimization and transfer to a compact form acceptable for further disposal. In this regard, the development of new efficient technologies for processing LRW and the improvement of existing ones does not lose its relevance. Since LRW is an aqueous solution of complex radionuclide and chemical composition, the most promising approach is to use selective inorganic adsorption and ion exchange materials. Currently various materials are being studied that are more or less indifferent to the salt background and are suitable for the processing of LRW: oxides and hydroxides of metals, modified natural adsorbents, titanosilicates, ferrocyanides of transition metals, phosphates of multivalent metals, including those obtained from industrial and agricultural wastes.

The adsorption strength of radionuclides is one of the factors that must be taken into account when evaluating the possibility of practical use of adsorbents. This is due to the risks associated with the possibility of migration of radionuclides to the external environment at various technological stages of handling spent adsorbents. As a rule, spent adsorbents are immobilized in cement or other matrices. A number of technological operations are carried out, which may include centrifugation and removal of excess liquid phase, grinding, physical and chemical processing, etc. At each stage, compliance with regulated requirements for the safe handling of liquid and solid radioactive waste (SRW) is required.

Sodium zirconium phosphates $NaZr_2P_3O_{12}$ and calcium zirconium $CaZr_4P_6O_{24}$, also known as NZP materials, due to the features of the crystal chemical structure, the NZP phosphate family has a number of unique properties, in particular, the stability of the structure with respect to ion substitution in various lattice sites, high thermal and radiation resistance, which makes them a promising material for the immobilization of long-lived radionuclides for subsequent safe disposal.

In this paper, we attempted to synthesize adsorbents based on calcium magnesium phosphates using mixed tertiary and hydrogen calcium magnesium phosphates obtained by phosphating natural dolomite under various conditions, and zirconyl nitrate as a zirconium-containing precursor. As far as we know, there are no data in the literature on the synthesis of NZP phosphate materials using the proposed method. The relevance of the synthesis of these phosphates is due, on the one hand, to their supposed high efficiency as adsorbents of long-lived radionuclides of cesium, strontium and cobalt, and, on the other, to the possibility of immobilization and safe disposal of spent adsorbents by heat treatment and transformation into calcium zirconium $CaZr_4P_6O_{24}$ and magnesium zirconium $MgZr_4P_6O_{24}$ phosphate ceramic matrices. The main highlights of report are included:

i. The facile synthesis of calcium magnesium zirconium phosphate adsorbents was developed;

ii. The obtained adsorbents had superior adsorption affinity towards 137Cs, 85Sr, 60Co

radionuclides;
iii. The formation of MZr4P6O24 (M: Ca, Mg) ceramic matrix during adsorbents calcination was shown;
iv. Insights into phosphate adsorbents development for radionuclides immobilization was demonstrated.
The presented results are important for understanding the possibilities of efficient liquid radioactive wastes decontamination by calcium magnesium zirconium phosphate adsorbents and safe disposal of spent adsorbents in ceramic matrix.

Materials Sciences: Keynote Speech Session I

Keynote Speech 1: A Quantitative Characterization and Assessment of Quality of Thin Films over Substrates with the Measurement of Material Properties

Speaker: Prof. Ji Wang, Ningbo University, China
Time: 08:30-09:10, Saturday Morning, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
Thin film layers of commonly used materials such as metals are frequently used in components and structures for various functions with many processing technologies. With extended requirements, it is always beneficial to have film material characterized for mechanical properties and other factors such as bonding strength and surface roughness. Among many techniques for the measurement and assessment, methods based on nondestructive technology such as acoustic waves are always preferred for its advantages such as in-situ, fast, and noncontact features. To improve such measurement, we consider a thin film layer with rough surface on a perfect substrate for the acoustic wave properties in relation to both material properties. By calculating the velocity of surface acoustic waves with the consideration of material properties and surface roughness, more accurate properties of the layer and the affinity are obtained to enable accurate estimation as part of the characterization and assessment procedure. Further improvement will be the consideration of the bonding between two materials so the affinity properties can also be assessed. It is believed such analysis will lead to possible novel approaches for the assessment of the film layer quality and bonding condition. Such a method can be used for the measurement of visible and hidden film layers with known properties of the substrate and thin film layer for enhanced assessment of the layered structure to satisfy engineering needs.

Keynote Speech 2: 3D Woven Composites: A Promising Platform for Advanced Multifunctional Structures

Speaker: Prof. Fujun Xu, College of Textiles of Donghua University, China
Time: 09:10-09:50, Saturday Morning, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
The composite structures with lightweight, excellent mechanical and multifunctional properties are crucial to their applications in the fields of industrial, civil as well as aerospace engineering. Traditional laminate composites which are mainly made of fiber or fabric, are prone to lamination failure of low-speed impact or shear to load. Three-dimensional (3D) woven fabric reinforced composites, due to the exist of vertical binding yarn, exhibit extraordinary structural integrity and delamination resistance. Furthermore, the multi-layer integrated structure of 3D woven fabric provides a proper environment for the embedded functional fibers. In this speech, mechanical, thermal as well as dielectric properties of the 3D woven composites will be introduced. Moreover, some multifunctional structures based on 3D woven composites, such as 3D textile antenna, 3D woven sensing and E-heating composites will be introduced.

Keynote Speech 3: A two-scale multi-physics deep learning model for smart MEMS sensors (Video)

Speaker: Dr. Stefano Mariani, Department of Civil and Environmental Engineering of the Polytechnic University of Milan, Italy
Time: 09:50-10:30, Saturday Morning, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
Smart materials and structures, especially those bio-inspired, are often characterized by a hierarchy of length-scales and, accordingly, time-scales. Smart Micro Electro-Mechanical Systems (MEMS), either used as sensors or actuators, are on their own characterized by different physical phenomena affecting their properties at different scales. Data-driven formulations can then be helpful to deal with the complexity of the multi-physics governing their response to the external stimuli, and optimize their performances. As a concrete example, Lorentz force micro-magnetometers can be adopted for navigation purposes, thanks to the interaction of the Earth magnetic field with a current flowing inside a semiconducting, micro-structured medium. If an alternating current with an ad-hoc set frequency is let to flow

longitudinally in a slender mechanical part, or beam, the system is driven into resonance and the sensitivity to the magnetic field to be sensed may result largely enhanced. In our former research activity, a single-axis Lorentz force MEMS magnetometer with a simple geometry was proposed, validated and fabricated; a reduced-order physical model of its movable structure was also developed, to feed a multi-physics and multi-objective topology optimization procedure. This model-based approach did not account for stochastic effects, which lead to the scattering in the experimentally acquired data at such micrometric length-scale. The formulation is here improved to allow for such stochastic effects through a 2-scale deep learning model designed as follows: at the material scale, a deep neural network is adopted to learn the scattering in the mechanical properties of polysilicon induced by its (poly)crystalline morphology; at the device scale, a physical model is adopted to account for the effects of scattering in the environment-driven etch defects on the overall response of the device; still at the device scale, a further deep neural network is adopted to learn the most important geometric features of the movable parts that affect the overall performance of the magnetometer. Some preliminary results are discussed, and the extension to more complex geometries is finally foreseen.

Keynote Speech 4: Perovskite Photovoltaics for Indoor Light Harvesting (Video)

Speaker: Dr. Thomas M. Brown, Department of Electronic Engineering, University of Rome Tor Vergata, Italy
Time: 10:40-11:20, Saturday Morning, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
The Internet of Things revolution requires a low-cost, stable and efficient power source to allow autonomous operation of smart objects and wireless sensors networks. These need to operate indoors under artificial lighting with different spectra and power outputs compared to standard test conditions, i.e. under the sun. Here we show the progress achieved in our labs in developing perovskite solar cells for these conditions achieving 27% efficiency on rigid glass substrates under 200-400lx white LED illumination via optimization of effective electron transport layers. Via low temperature fabrication of device architectures, including mesoporous scaffolds, we manufactured 10%-12% efficient dye sensitized solar cells on metal substrates, 13% efficient perovskite cells on transparent PET films as well as over 22% on curvable ultra-thin glass substrates which represents the highest value for any PV flexible technology to date.

Keynote Speech 5: Nanostructured silicas with enhanced acidity – new concepts of synthesis (Video)

Speaker: Dr. Maciej Trejda, Adam Mickiewicz University, Poland
Time: 11:20-12:00, Saturday Morning, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
Catalytic processes based on solid acidic materials are very important as a great variety of valuable products can be obtained in the presence of acid sites. Nevertheless, most of esterification processes are mainly based on the application of mineral acids used as homogeneous catalysts. However, the application of mineral acids leads to some difficulties, for example related to corrosion of equipment or production of large amounts of waste products. Therefore, many attempts have been undertaken to eliminate the above-mentioned problems via the process heterogenization. On the other hand, a bulky character of reactants dictates the application of solid catalysts having a porous nature which permits the diffusion to/from the active centers. The preferred support for such catalyst are mesoporous silicas with defined porous structure. The acidic catalysts obtained by the immobilization of organosilanes on silica supports will be presented in the lecture. A different methodology for the material synthesis leading to an increase in the number or the strength of acidic sites will be discussed.
The activity of the catalysts proposed were examined in different esterification processes including acetic and propionic acid esterification with glycerol, ethanol, 2-propanol, n-butanol or n-hexanol. These processes could be considered as model test reactions but they are also important from the industrial point of view. For instant glycerol is a side product of biodiesel formation from vegetable oils. The esterification of acetic acid with this alcohol leads, inter alia, to formation of triacetin, which is the valuable additive for biodiesel blending. In this context the focus of the lecture will also refer to the environmental aspects dealing with the so-called "green chemistry".

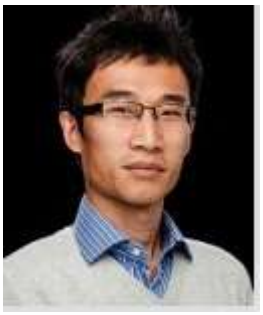
Materials Sciences: Keynote Speech Session II

Keynote Speech 6: Light weighting of metal structures by metallurgical means; the avenue of severe plastic deformation (Video)

Speaker: Prof. Laszlo S. Toth, Laboratory of Excellence on Design of Alloy Metals for Low-mAss Structures (DAMAS), Universit éde Lorraine, France
Time: 14:00-14:40, Saturday Afternoon, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
One way of reducing the mass of a metallic structure is to use stronger metal. A metal with higher yield limit permits to reduce the thickness of a structural element while bearing the same load. Material strengthening of metals can be achieved by producing fine microstructures which can be obtained by alloying or by nano-structuring. Severe plastic deformation (SPD) has been used since long time for reducing the grain size thus, increase the strength via the Hall-Petch effect, without alloying the metal. The research in SPD has been very intensive since about 30 years. New SPD processes were established which permit to approach the theoretical yield limit of metals that are ultra-fine grained or even nano-structured. Such structures are obtained by a grain fragmentation process due to large plastic strains. This lecture will first overview the most well-known SPD processes, then present the latest ones that are able to bring the metal into its limiting stage of grain fragmentation in a single deformation step, thus candidates for industrial applications. Insight will be given on the grain fragmentation process and on the mechanical/thermal stability of the UFG/nano-grained microstructures.

Keynote Speech 7: Additive manufacturing of aluminium: alloy design and process optimisation (Video)



Speaker: Dr. Xiaopeng Li, The School of Mechanical and Manufacturing Engineering, The University of New South Wales (UNSW Sydney), Australia
Time: 14:40-15:20, Saturday Afternoon, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
Additive manufacturing, in particular laser powder bed fusion technique (LPBF), has been widely used to fabricate various aluminium alloys including Al-Si, 6061, 7075 alloys in the past decade with the aim to target applications concerning high strength and

light-weighted structures. However, due to intrinsic materials characteristics, e.g., solidification cracking, not many aluminium alloys have satisfactory LPBF processability. Therefore, it is in urgent need to design and develop more suitable aluminium alloys and their composites for LPBF manufacturing. Meanwhile, once new aluminium alloys are designed, it is also of great importance to optimise the LPBF process to achieve high quality components without any apparent processing defects such as cracks or porosity. Moreover, how to achieve the desired mechanical properties in these aluminium alloys via manipulating the LPBF optimised parameters is another interesting and profound topic. In this presentation, a novel in-situ alloy design process was first introduced to develop nanoparticle decorated aluminium alloys for LPBF and the resultant microstructure along with mechanical properties were investigated. Following this, a machine-learning assisted LPBF process optimisation process for aluminium alloys is described in detail to provide new insights into the microstructure control and properties manipulation of LPBF fabricated aluminium alloys.

Keynote Speech 8: Advances in Laser Based Additive Manufacturing of Exotic Alloys (Video)

Speaker: Dr. Guijun Bi, Singapore Institute of Manufacturing Technology (SIMTech), Singapore
Time: 15:20-16:00, Saturday Afternoon, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
In recent years, exotic alloys, such as high entropy and medium entropy alloys, metal matrix composite and functionally graded alloys, etc. have drawn great attention in academia and industry owing to the excellent mechanical properties at ambient, cryogenic and high temperatures. Laser based additive manufacturing technologies, namely laser powder bed fusion (LPBF) and laser directed energy deposition (L-DED) provide huge advantages over conventional methods for processing and developing new exotic alloys. In this talk, advances in laser additive manufacturing of exotic alloys are presented. Motivations, methodology and results of the obtained microstructures, phases and material properties for processing different exotic alloys are introduced in detail. Relationships among the material, additive manufacturing processes, microstructure & phase formation and mechanical properties and strengthening mechanisms are discussed. Future trends in laser based additive manufacturing will be highlighted.

Keynote Speech 9: INFORMATION RETRIEVAL IN INTERNET OF THINGS

(Video)

Speaker: Dr. Mohd Afizi Mohd Shukran, Universiti Pertahanan Nasional Malaysia (UPNM), Malaysia
Time: 16:10-16:50, Saturday Afternoon, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract

Information retrieval involves solving problems by analysing data already present in databases. Due to the explosive growth of both business and scientific databases, extracting efficient classification rules from such databases has become an important task. This is because classification technique is an important form of knowledge extraction and can help to make key decisions. Nevertheless, classification technique can be improved by integrating the latest technology, namely, Swarm Intelligence. This study proposes two types of classification techniques: Artificial Bee Colony, and Intelligent Dynamic Swarm, which are both based on Swarm Intelligence. This is because Swarm Intelligence has the capability to adapt well in changing environments and is immensely flexible and robust. The first swarm based classifier involves using the advantages of Artificial Bee Colony as an optimization tool to do the information retrieval. This proposed Artificial Bee Colony based classifier has been implemented to the Anomaly based Network Intrusion Detection System. To our knowledge, it is the first time that the Artificial Bee Colony technique has been applied to solve the network intrusion detection problem. Another swarm based classifier that has been proposed in this study is a novel Intelligent Dynamic Swarm, which is based on Particle Swarm Optimization. Unlike a conventional Particle Swarm Optimization algorithm, this novel algorithm can directly cope with discrete variables. In addition, Intelligent Dynamic Swarm can successfully avoid premature convergence, which is considered a serious drawback of traditional Particle Swarm Optimization. These two proposed new swarm based information retrieval algorithms have been evaluated using the UCI data set, KDD-99 datasets developed by MIT Lincoln Labs, and the pre-processed image data. The experimental results showed that both the Anomaly based Network Intrusion Detection System and Intelligent Dynamic Swarm are robust and able to achieve high classification accuracy in a changing environment within the data instances. Therefore, both proposed classifiers can provide a promising direction for solving complex problems that may not be solved by traditional approaches.

Keynote Speech 10: TBD (Video)

Speaker: Dr. Afshin Abrishamkar, McMaster University (McMaster), Hamilton, Canada.
Time: 16:50-17:30, Saturday Afternoon, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
TBD

Keynote Speech 11: USING ADVANCED COMPOSITE MATERIALS IN CONSTRUCTION INDUSTRY DEVELOPMENT (Video)

Speaker: Prof. Tarek Aly Elsayed, Mataria Helwan University, Egypt
Time: 17:30-18:10, Saturday Afternoon, Aug. 21, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
Nowadays advanced composite materials are widely spread over the world. These materials are such as chemical building materia ls, polymers, epoxies, and polyesters, and synthetic fibers and their fabrics and products. Chemical building materials are used in manufacturing advanced composite materials, such as high strength concrete (HSC), self-compacting concrete (SCC), ultra-high strength concrete (UHSC), and light weight concrete (LWC). Also, chemical building materials together with synthetic fibers are used in manufacturing fiber reinforced concrete (FRC), and in manufacturing fiber reinforced polymers fabrics those are used as external techniques for repair, strengthening, retrofitting most types of structures. This not only helps in repairing, strengthening, and retrofitting structures, but also helps in development and accommodating structures. This is a big value, as in some structures the cost of demolition are highly expensive than repair. Also, some buildings are of big value, such as buildings owing special heritage such as historic buildings, and building with special architectural heritage, those are a commonwealth and the main source of income in many countries over the world. Summary of some research and examples from real life of the efficiency of using advanced composite materials in construction industry are presented herein. Also methodologies for enhancing the efficiency of the FRP external strengthening techniques are presented.

Materials Sciences: Keynote Speech Session III

Keynote Speech 12: TBD (Video)

Speaker: Prof. Chaozong Liu, University College London, UK
Time: 08:30-09:10, Sunday Morning, Aug. 22, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
TBD

Keynote Speech 13: WASTE TO WEALTH BASED CARBON NANOSTRUCTURES AND THEIR EXCITING APPLICATIONS (Video)

Speaker: Prof. Gurumurthy Hegde, Centre for Nano-materials and Displays (CND), India
Time: 09:10-09:50, Sunday Morning, Aug. 22, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
Due to ever growing industry revolution left tonnes of wastes into the society. Biowaste is one such waste which is abundantly available and needs to be tackled in the coming days. Lot of technology is devoted to converting biowastes to composts, electricity etc in place but converting biowaste into nanotechnology is always a fascinating field of research. Here in this talk, I am going to explain how to finetune the biowastes and then to convert them into porous carbon nanostructures. Emphasis is given to tuning the porosity and surface area of such structures. Special attention is given to applications like suypercapacitors, water purification, composite structures, catalysis using such porous nanostructures.

Keynote Speech 14: Polymeric Materials for Organogenic Printing (Video)

Speaker: Prof. Rajiv Dutta, Shobhit Institute of Engineering & Technology, India
Time: 09:50-10:30, Sunday Morning, Aug. 22, 2021
Location: TBD, 2nd Floor, Guilin Grand Link Hotel, China

Abstract
Three-dimensional (3D) bioprinting is a printing technology in which biological organs and tissues are printed three dimensionally, using a layer-by-layer approach. The organs obtained through this technique may have application in organ transplantation, for screening newly developed drugs and physiological studies of drug assimilation. The demand on the organ transplantation and uncertainty over the evaluation of newly formulated drugs on animal organs necessitated the utilization of 3D printing technology in the field of medical science. The process of 3D organ printing were done in three steps e.g. prebioprinting, bioprinting, and postbioprinting. The first step involves formation of organ blueprint and material selection with the utilization of imaging technologies to capture of organ blueprint. These include computed tomography (CT), magnetic resonance imaging (MRI) and X-ray with CCD or MOSFET. The information is then transformed into digital language and this information provides the 3D representation of the image and the information is prototyped by the 3D printer. The selection of polymeric material depends on the physiology of the organ to be synthesized, its utilization and the type of printer adopted. The printing refers to the actual prototyping of the organ, in which foundation of the organ is formed first, then the print head moves above to form the next layer and in the same way the organ model is developed. The poststep involves conditioning of the developed prototype of the organ through the proliferation and differentiation process. This is achieved by incubating the organ at specified environment and temperature for a specified period of time in a bioreactor

Part III Technical Sessions

Physics Sciences: Technical Session

Session Chair:
Location: TBD, 2nd Floor

No.	Paper Title	Author	Affiliation
Keynote Speech	High-spin states and level structure in 80Rb and 84Rb	Prof. Shuifa Shen	Institute of Nuclear Energy Safety Technology, CAS, China
Keynote Speech	The application of the activation technique within the technological advances	Prof. Nikolas Patronis	Department of Physics University of Ioannina, Greece
Keynote Speech	The Geometry Effect of the Source-to-detector Space on Calculation of Coincidence Summing Factors in Gamma-Ray Spectrometry Field	Prof. Mohamed Salem Badawi	Faculty of Science, Beirut Arab University, Lebanon
10:30-10:40	**Group Photo & Coffee Break**		
Keynote Speech	Properties and transmutation of magnetized heavy nuclei	Prof. Vladimir Kondratyev	Bogoliubov Laboratory of Theoretical Physics, JINR, & Dubna State University, Russia
Keynote Speech	Calcium magnesium zirconium phosphate: From adsorption to radioactive wastes disposal	Dr. Andrei Ivanets	National Academy of Sciences of Belarus, Belarus
Oral	Facile Preparation of Novel Manganese Dioxide Modified Nanofiber and Its Uranium Adsorption Performance	Wuqing Tao	Department of Radiochemisty, China Institute of Atomic Energy, Beijing, China
Oral	Diversity of acoustofluidic field in an ultrasonic cavity generated by multiple vibration sources	Qiang Tang	Faculty of Mechanical and Material Engineering, Huaiyin Institute of Technology
Oral	DIESEL ENGINE FAULT DIAGNOSIS WITH	Tha ranga	College of Power

	VIBRATION SIGNAL		Engineering
Oral	Block Iterative STMV Algorithm and Its Application in Multi-targets Detection	ZHU Daizhu	Shanghai Marine Electronic Equipment Research Institute

Materials Sciences: Technical Session

Session Chair:
Location: TBD, 2nd Floor

No.	Paper Title	Author	Affiliation
Keynote Speech	TBD	Prof. Chaozong Liu	University College London, UK
Keynote Speech	WASTE TO WEALTH BASED CARBON NANOSTRUCTURES AND THEIR EXCITING APPLICATIONS	Prof. Gurumurthy Hegde	Centre for Nano-materials and Displays (CND), India
Keynote Speech	Polymeric Materials for Organogenic Printing	Prof. Rajiv Dutta	Shobhit Institute of Engineering & Technology, India
10:30-10:40	**Group Photo & Coffee Break**		
Oral	Crystal defects and phase transitions of nanocrystalline yttria-stabilised zirconia induced by high-energy ball milling	Ning Wang	Grirem Advanced Materials Co.,Ltd.
Oral	Microstructure, texture evolution and yield strength symmetry improvement of as-extruded ZK60 Mg alloy via multi-directional impact forging	Chao Cui	Harbin Institute of Technology
Oral	Hierarchical microstructure and dual-nanoprecipitate of a selective-laser-melted AlZnMgCuScZr alloy with superior mechanical properties	Wenjun Lu	Department of Mechanical and Energy Engineering, Southern University of Science and Technology
Poster	Neutral amino acids as novel cell cryoprotectants	Xiaojie Sui	Department of Biochemical

			Engineering, School of Chemical Engineering and Technology, Tianjin University, Tianjin, China.
Poster	Zwitterionic hydrogel coated titanium surface with high-efficiency endothelial cell selectivity for rapid re-endothelialization	Chiyu Wen	Tianjin University
Poster	Fabrication of anti-icing surfaces by a bioinspired diblock functional protein	Yihang Gao	Tianjin University
Poster	Study on Osteogenic Effect Using Porous Hydroxyapatite Scaffold-Based Delivery of Human Placenta-Derived Mesenchymal Stem Cells	Ren Xiaohua	Department of stomatology, Sichuan Provincial People's Hospital
Poster	Assembly process of Amelogenin in construction of enamel skeleton	Kun Tian	University of Electronic Science and Technology of China

Part IV Abstracts

Physics Sciences

ID: SNSA2021_20000

Title: Facile Preparation of Novel Manganese Dioxide Modified Nanofiber and Its Uranium Adsorption Performance

Name: Wuqing Tao

Affiliation: Department of Radiochemisty, China Institute of Atomic Energy, Beijing, China

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Abstract

In this study a novel manganese dioxide modified nanofiber was facile prepared using the electrospinning technique. The as-prepared manganese dioxide/poly(vinyl alco-hol)/poly(acrylic acid) (briefly as MnO2-PVA/PAA) was firstly characterized by SEM, FT-IR, XRD, stress-strain test and secondly tested as an adsorbent to remove uranium from aqueous solution. Effect of pH, ionic strength, initial uranium concentration, mixing time, temperature on the adsorption, reusability and adsorption mechanism were illustrated. The theoretical adsorption amount of MnO2-PVA/PAA calculated as 398.85 mg/g was competitive compared with the reported values. The study proved MnO2-PVA/PAA is promising in the uranium removal from aqueous medium.

ID: CAVNC2021_20012

Title: Diversity of acoustofluidic field in an ultrasonic cavity generated by multiple vibration sources

Name: Qiang Tang

Affiliation: Faculty of Mechanical and Material Engineering, Huaiyin Institute of Technology

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Abstract

Two-dimensional acoustofluidic field in an ultrasonic chamber actuated by segmented ring-shaped vibration sources with different excitation phases are simulated by COMSOL Multiphysics. Diverse acoustic streaming patterns including aggregation and rotational modes can be feasibly generated by the excitation of several sessile ultra-sonic sources which only vibrate along radial direction. Numerical simulation of parti-cle trajectory driven by acoustic radiation forces and streaming-induced drag forces also demonstrates that micro-scale particles suspended in the acoustofluidic chamber can be trapped in the velocity potential well of fluid flow or rotate around the cavity center with the circumferential acoustic streaming field. Preliminary investigation of simple Russian doll or Matryoshka type configurations (double-layer vibration sources) provide a novel method of multifarious structure design in future researches on the combination of phononic crystal and acoustic streaming. The implementation of multiple segmented ring-shaped vibration sources offers flexibility to control acous-tic streaming field in microfluidic devices for various applications. We believe that this kind of acoustofluidic design is expected to be a promising tool for the investigation of rapid microfluidic mixing on a chip and contactless rotational manipulation of bi-osamples like cells or nematodes.

ID: CAVNC2020_10000

Title: DIESEL ENGINE FAULT DIAGNOSIS WITH VIBRATION SIGNAL

Name: Tha ranga

Affiliation: College of Power Engineering

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Abstract

When the vibration of diesel engine structure is measured, the signal is composed of a very complex

superposition of the contributions of different vibratory sources modified by their respective transmission paths. These sources originate from several internal phenomenon in the engine such as combustion pressure variation, unbalanced reciprocating and rotating parts. In a diesel engine, movement parts work in a specific order. Once the starting point is determined, occurrence of work order in different cycle phases can be determined. This could successfully use to identifying of impulses in complex vibration signal of a diesel engine. From the variation of features of those impulses, it is possible to determine the working condition of the engine. This can use to fault diagnosis of diesel engine, specially faults related to combustion process.

ID: CAVNC2020_10001
Title: Block Iterative STMV Algorithm and Its Application in Multi-targets Detection
Name: ZHU Daizhu
Affiliation: Shanghai Marine Electronic Equipment Research Institute
Email: zdz91511@sina.com

Abstract
STMV beamforming algorithm needs inversion operation of matrix, and its engineering application is limited due to its huge computational cost. This paper proposed block iterative STMV algorithm based on one-phase regressive filter, matrix inversion lemma and inversion of block matrix. The computational cost is reduced approximately as 1/4M times as original algorithm when array number is M. The simulation results show that this algorithm maintains high azimuth resolution and good performance of detecting multi-targets. Within 1~2dB directional index and higher azimuth discrimination of block iterative STMV algorithm are achieved than STMV algorithm for sea trial data processing. And its good robustness lays the foundation of its engineering application.

Materials Sciences

ID: CMN2021_20005
Title: Crystal defects and phase transitions of nanocrystalline yttria-stabilised zirconia induced by high-energy ball milling
Name: Ning Wang
Affiliation: Grirem Advanced Materials Co.,Ltd.
Email: n-wang04@139.com

Abstract
Yttria-stabilised zirconia (YSZ) is a promising electrolyte for SOFCs and gas sensors. In this study, the particle size of a co-precipitated 5 mol% yttria-stabilised zirconia (5YSZ) powder was refined from 10.47 μm to 130 nm via high-energy ball milling to improve its sinterability and ionic conductivity. The ball milling process increased the specific surface area of the 5YSZ powder from approximately 11 to 22 m2·g-1. The transmission electron microscopy (TEM) and high-resolution TEM (HRTEM) results indicated that the 5YSZ crystallites decomposed into irregular shapes with the evolution of point, linear, and planar defects. An increase in the milling duration increased the number of oxygen defects in the 5YSZ powder, as revealed by the X-ray photoelectron spectroscopy results. The tetragonal-to-monoclinic phase transformation occurring in the powder was investigated by X-ray diffraction, Raman spectroscopy, HRTEM, and selected-area electron diffraction pattern analyses. The ball-milled powders could be easily densified, but the presence of too many crystal defects and the large fraction of the m-ZrO2 phase were detrimental

to the further densification of the 5YSZ powders. In spite of the high sintering temperature (1500 ℃) used in this study, the maximum relative density of 99.67% could be achieved for the powder ball-milled for 60 min at the rotor speed of 1500 rpm. Moreover, like the density, the grain boundary conductivity of 5YSZ changed significantly from 9.02 to 18.15 mS•cm-1 (380 ℃) after the ball milling process.

ID: LAMM2021_20004

Title: Microstructure, texture evolution and yield strength symmetry improvement of as-extruded ZK60 Mg alloy via multi-directional impact forging

Name: Chao Cui

Affiliation: Harbin Institute of Technology

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Abstract

Multi-direction impact forging (MDIF) was applied to the as-extruded ZK60 Mg alloy, and the microstructure, texture evolution and yield strength symmetry were investigated in the current study. The results showed that the average grain size of forged piece was greatly refined to 5.3 μm after 120 forging passes, which was ascribed to the segmenting effect of {10-12} twins and the subsequent multiple rounds of dynamic recrystallization (DRX). A great deal of {10-12} twins were activated at the beginning of MDIF process, which played an important role in grain refinement. With forging proceeding, continuous and discontinuous DRX were successively activated, resulting in the fully DRXed microstructure. Meanwhile, the forged piece exhibited a unique four-peak texture, and the initial <10-10>//ED fiber texture component gradually evolved into multiple texture components composed of <0001>//FFD (first forging direction) and <11-20>//FFD texture. The special strain path was the key to the formation of the unique four-peak texture. The {10-12} twinning and basal slip were two dominant factors to the evolution of texture during MDIF process. Grain strengthening and dislocation strengthening were two main strengthening mechanisms of the forged piece. Besides, the symmetry of yield strength was greatly improved by MDIF process.

ID: LAMM2021_20003

Title: Hierarchical microstructure and dual-nanoprecipitate of a selective-laser-melted AlZnMgCuScZr alloy with superior mechanical properties

Name: Wenjun Lu

Affiliation: Department of Mechanical and Energy Engineering, Southern University of Science and Technology

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Abstract

Achieving high mechanical strength and ductility in age-hardenable Al alloys fabricated by selective laser melting (SLM) remains challenging. Here, we show that crack-free AlZnMgCuScZr alloys with an unprecedented strength–ductility synergy can be fabricated via SLM and heat treatment. The as-built samples had an architectured microstructure consisting of a multimodal grain structure and a hierarchical phase morphology. It consisted of primary Al3(Scx,Zr1-x) particles which act as inoculants for ultrafine grains, preventing crack formation. The metastable Mg-, Zn-, and Cu-rich icosahedral quasicrystals (I-phase) ubiquitously dispersed inside the grains and aligned as a filigree skeleton along the grain boundaries. The heat treated SLM-produced AlZnMgCuScZr alloy exhibited tunable mechanical behaviors through trade-off among the hierarchical features, including the dual-nanoprecipitation, viz, η' phase, and secondary (Al,Zn)3(Sc9Zr), and grain coarsening. Less coarsening of grains and (Al,Zn)3(Sc9Zr) particles, due to a reduced solution treatment temperature and time, could overwhelm the more complete dissolution of I-phase (triggering more η' phase), resulting in higher yield strength. Optimal combination of the hierarchical features yields the

highest yield strength (~647 MPa) among all reported SLM-produced Al alloys to date with appreciable ductility (~11.6%). The successful fabrication of high-strength Al alloys with an adjustable hierarchical microstructure paves the way for designing and fine-tuning SLM-produced aluminum engineering components exposed to high mechanical loads.

ID: ICBM2021_20000
Title: Neutral amino acids as novel cell cryoprotectants
Name: Xiaojie Sui
Affiliation: Department of Biochemical Engineering, School of Chemical Engineering and Technology, Tianjin University, Tianjin, China.
Email: sui_xiaojie@tju.edu.cn

Abstract
Cryoprotectants are crucial to successful cell cryopreservation because they can reduce cryoinjuries to cells associated with ice formation. To meet the clinical requirements of post-cryopreserved cells, cryoprotectants should be biocompatible, highly efficient and easily removed from cells. However, current cryoprotectants still face the challenge of simultaneously integrating these properties. Herein, three biocompatible neutral amino acids, including β-alanine, γ-aminobutyric acid and ε-aminocaproic acid, are first reported to have the potential as such ideal cryoprotectants. Results demonstrate that they can inhibit ice formation and reduce osmotic stress to provide extracellular and intracellular protection, thus ensuring high cryopreservation efficiency for both anuclear and nucleated cells. More importantly, because of the remarkable osmotic regulation ability, the neutral amino acids can be rapidly removed from cryopreserved cells via a one-step method without causing observable damage to cells, superior to the current state-of-the-art cryoprotectants-dimethyl sulfoxide and glycerol. This work provides a new perspective to develop novel cryoprotectants, which may have dramatic impacts on solvent-free cryopreservation technology to support cell-based applications, such as cell therapy and tissue engineering, etc.

ID: ICBM2021_20001
Title: Zwitterionic hydrogel coated titanium surface with high-efficiency endothelial cell selectivity for rapid re-endothelialization
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Abstract
Cardiovascular disease is one of the leading causes of death worldwide. Coronary stent implantation is an effective strategy for cardiovascular disease treatment. Clinically, originating from the well-suited mechanical property and easy workability, metal stents are still the most commonly used percutaneous interventional stents. However, stent implantation inevitably causes endothelial cell (EC) damage, the exposure of subintimal components may lead to platelet activation and aggregation, fibrinogen binding, thrombus formation and smooth muscle cells (SMCs) proliferation. Therefore, bioactive molecular immobilization has been regarded as a superior option to achieve rapid re-endothelialization and enhance the long-term therapeutic efficacy of stents.

REDV peptide is a tetrapeptide sequence which can be specifically recognized by receptor α4β1, an integrin abundantly existed on ECs but bared on SMCs. Carboxybetaine (CB) is one of the most widely studied zwitterionic materials that exhibits excellent antifouling properties. Moreover, CB hydrogel bearing abundant carboxylate groups enables the convenient immobilization of amine-containing elements via simple EDC/NHS chemistry.

Combining the merits of fouling repellency and ECs

selectivity, we develop a REDV functionalized CB hydrogel coating (REDV/CB) on Ti surface for inhibited biofouling adhesion and promoted re-endothelialization. Zwitterionic CB hydrogel conjugated on Ti is capable for resisting various bio-foulants via ionic solvation effect-induced hydration layer. REDV peptide is covalently grafted on CB to achieve ECs specific capture, endowing this coating with simultaneously enhanced re-endothelialization and reduced SMCs propagation. The coating is fixed on the substrate via covalent immobilization, which is more competent to provide sufficient mechanical compliance than non-covalent method. This work is envisioned to provide a promising strategy to simultaneously resist nonspecific fouling and promote in situ re-endothelialization of vascular stents.

ID: ICBM2021_20002

Title: Fabrication of anti-icing surfaces by a bioinspired diblock functional protein

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Abstract

Ice formation plays a serious problem in industry applications such as aircrafts, automobile, coating technology, wind turbines, etc, which may damage to the cold resistance of equipment and leads to high energy and economy losses. Fortunately, antifreeze proteins (AFPs) as an evolutionary adaptation of organisms to cold climates, which provides a solution for icing problems. For instance, Type III and snow flea AFPs were reported to attach to polymer chains on the glass to inhibit ice formation and growth. The coated glass slides did not freeze even after 30 min when cooled at -6.0 ℃, which were confirmed to be used as coatings for device components to repel ice buildup. However, it is a challenge to anchor antifreeze proteins to surface gently because AFPs may denature and loss their antifreeze activity. Besides, chemical modification is labor-intensive. In this work, we designed a novel chimeric protein Mfp-AFP both have adhesive domain inspired by mussel and antifreezing domain inspired by Tenebrio molitor, which could be used for modifying diverse solid surfaces. Besides, Mfp-AFP can lower the freezing point of water and inhibit ice recrystallization. Mfp-AFP coated surfaces play an effective role in anti-frosting and delaying ice formation, and also have the ability of anti-fogging. Moreover, as protein materials, Mfp-AFP coated surfaces display excellent biocompatibility proved by cytocompatibility and hemolysis assays. The provided strategy offers a new direction for fabricating anti-icing surfaces, which has potential applications in display devices, windshields and periscopes.

ID: ICBM2021_20003

Title: Study on Osteogenic Effect Using Porous Hydroxyapatite Scaffold-Based Delivery of Human Placenta-Derived Mesenchymal Stem Cells

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Abstract

To explore the ectopic osteogenic effect and mechanism using porous hydroxyapatite with a grooved structure (HAG) scaffold-based delivery of human placenta-derived mesenchymal stem cells (hPMSCs). HE staining was used to study the osteogenic effect in beagle dog dorsal muscles, and RNA-Seq was used for exploring the osteogenic mechanism. HE staining demonstrated that the osteogenic ability and effector of the HAG scaffold-based hPMSC (HAG/hPMSC) group were significantly greater than those of the HAG scaffold (HAG) group. A large number of fibroblasts grew, and fibrous tissue formed, in both groups at four weeks after implantation, while there was osteoid formation on the surface of scaffolds in the

HAG/hPMSC group. After eight weeks, the area of the bone matrix in the HAG/hPMSC group was larger than that in the HAG group. After 12 weeks, mature bone plate structure could be seen in the HAG/hPMSC group. RNA-Seq showed that many osteogenesis-related pathways participated which are different at different stages in metabolism. Our results showed that the expression of COL-1 increased with time, indicating that bone formation also increased with time. Additionally, the expression level of RUNX2 increased with time, suggesting that osteoblasts differentiated more and more, and the corresponding amount of bone formation also increased. We preliminarily studied the ectopic osteogenic effect and mechanism of porous HAG scaffolds combined with hPMSCs in vivo. This was helpful for the better application of HAG scaffolds in the future.

ID: ICBM2021_20004

Title: Assembly process of Amelogenin in construction of enamel skeleton

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Abstract

Objective: To figure out the self-assembly process of human amelogenin at the beginning stage of enamel molding, we used cryogenic transmission electron microscopy in each step in vitro.

Methods： Full-length gene of amelogenin was amplified from total RNA of tooth germ, and the amelogenin cDNA was obtained by a reverse transcription-polymerase chain reaction. Build plasmid together with pMD19-T vector, transformed into E. coli Top10 to acquire purified proteins. The self-assembly at 1,10 and 20min was recorded by cryogenic transmission electron microscopy when pH jumped from 3.5 to pH 8.0.

Results： The morphology and structure of Amelogenin gradually changed over time when PH transferred from 3.5 to 8. Oligomers appeared in the early stages, then they further gathered into nanospheres, which finally integrated the reticular frame protein chains. As the pH value was 8.0, the amelogenin assembled from oligomers to polymers, nanospheres and nano chains step by step.

Conclusion： Under suitable conditions, the aggregation of human amelogenin into nanospheres is a hierarchical assembly process, which used as templates for apatite mineral’s growth of human enamel in vitr. The nanospheres attracted calcium ions and phosphate ions around them to offer a supersaturated solution environment, which is the molecular basisi of organized hierarchical microstructure of enamel.

Part V Instructions for Presentations

Oral Presentation

Devices Provided by the Conference Organizing Committee:

- Laptops (with MS-office & Adobe Reader)
- Projectors & Screen
- Laser pointer

Materials Provided by the Presenters:

- PowerPoint or PDF files

Duration of each Presentation:

- Regular Oral Session: 10-15 Minutes of Oral Presentation
- Keynote Speech: 40-45 Minutes of Keynote Speech

Poster Presentation

Materials Provided by the Conference Organizing Committee:

- X Racks & Base Fabric Canvases (60cm×160cm, see the figure below)
- Adhesive Tapes or Clamps

Materials Provided by the Presenters:

- Home-made Posters

Requirements for the Posters:

- Material: not limited, can be posted on the Canvases
- Size: smaller than 60cm×160cm
- Content: for demonstration of the presenter's paper

Part VII Hotel Information

About Hotel

Guilin Grand Link Hotel 桂林桂山华星酒店
Guilin Grand Link Hotel locates on the bank of Li River in the beautiful city of Guilin which enjoys the fame as “having the best scenery in China”. Facing the city badge the Elephant Trunk Hill across the river and adjacent to the Seven Star Park and ZiZhou Island Park. It is only 10 minutes’ ride to the downtown city, the railway station, the Hi-tech Industrial Zone and International Exhibition & Conference Center, 45 minutes to Guilin Liangjiang International Airport. It is the only luxury garden resort hotel on the Li River bank and near the gardens.

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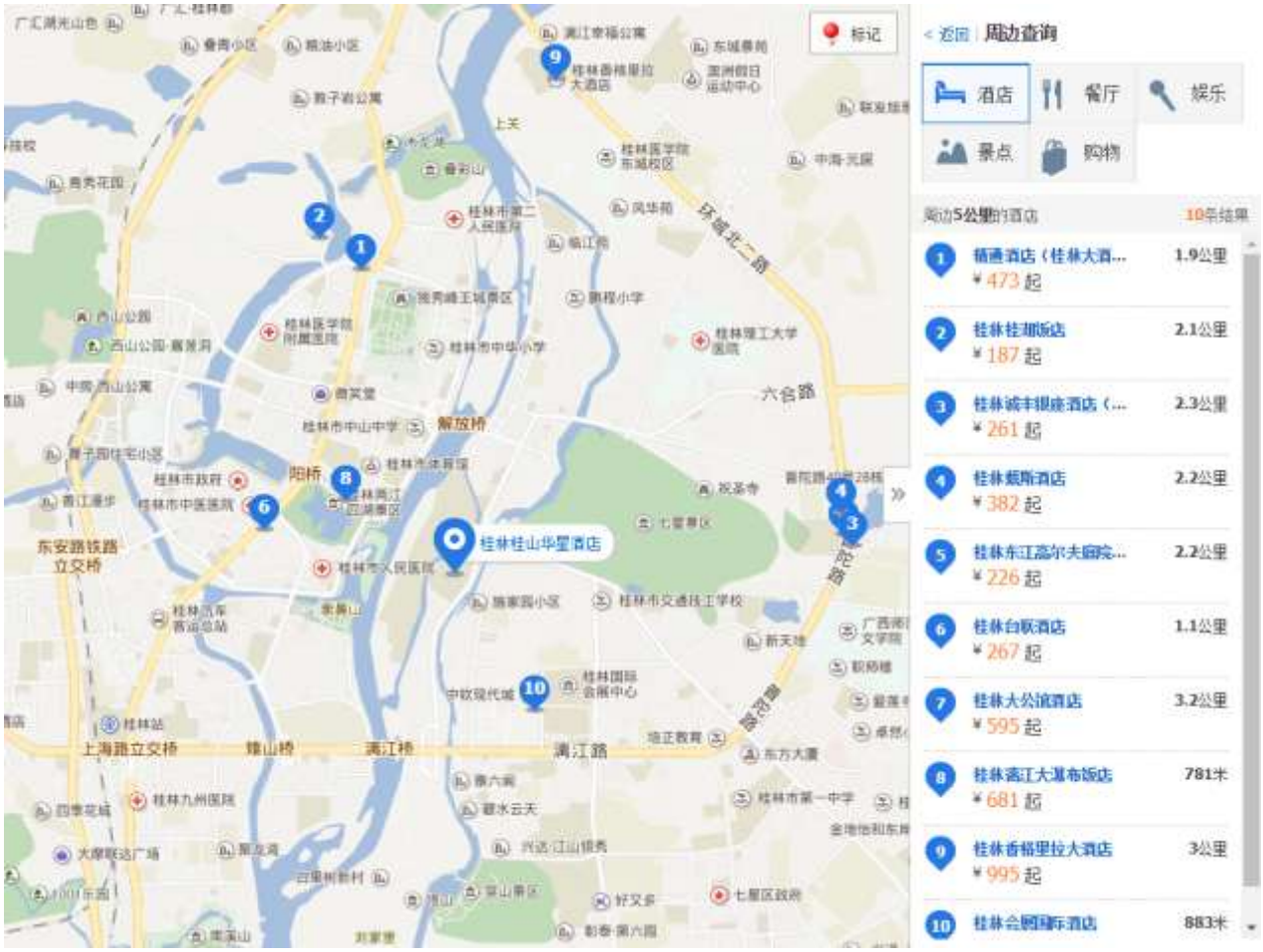
For authors who do not understand Chinese, please show the following info to the driver if you take a taxi:
请送我到：中国广西壮族自治区桂林市穿山路42号，桂林桂山华星酒店



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