CMPSE2021

2021 5th International Conference on Composite Material, Polymer Science and Engineering

November 15-16, 2021 | Bangkok, Thailand(On Virtual)

http://www.cmpse.org/

Welcome Messages

Dear colleagues,

It is our great pleasure and privilege to welcome you to the virtual edition of CMPSE2021, the 2021 5th International Conference on Composite Material, Polymer Science and Engineering. The conference will be held on November 15th, 2021 and is now accessible to registered participants worldwide.

On this great gathering, Organizing Committee invites participants from all over the globe to take part in this annual conference. The aim of CMPSE2021 is to provide a platform for researchers, engineers, and academicians, as well as industrial professionals, to present their research results and development activities in Composite Material, Polymer Science and Engineering Related Issue. This conference provides opportunities for the delegates to exchange new ideas and application experiences, to establish business or research relations and to find global partners for future collaboration.

Papers submitted to CMPSE2021 will be reviewed by technical committees of the conference. All accepted and registered papers will be published in "Key Engineering Materials" [ISSN print 1013-9826 ISSN cd 1662-9809 ISSN web 1662-9795], Trans Tech Publications]. And the press will submit all papers to major databases such as EI Compendex, Scopus and Scholar...

We would like to thank and welcome everyone, and hope you will enjoy CMPSE2021.

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Content

Note:

- All the participants are strongly advised to attend 10 minutes before the Webinar is start.
- Zoom ID and instructions will also be sent 7 days before the conference.
- The standard time for all programs is Thailand Time.

Instructions about Oral Presentation

- Materials Provided by the Presenters: PowerPoint or PDF files
- Duration of each Presentation: Regular Oral Session: About 10 Minutes of Presentation and 2 Minutes of Q&A.

Committee

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Professor Katsuyuki Kida, University of Toyama, Japan

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Academic Members

Time Schedule (Thailand Time, GMT+7)

November 15th, 2021

11:55-12:00	Opening Speech
12:00-14:30	Keynote Session
12:00-12:30	**Fatigue Damage Growth of Unidirectional Fibre Composites – Microscale Observations and Micromechanical Models** Professor Bent F. Sørensen | Technical University of Denmark, Denmark
12:30-13:00	**Failure analysis of fibre metal laminates subjected to impact and blast** Professor Zhongwei Guan | Technology Innovation Institute, UAE
13:00-13:30	**Targeted exploitation of anisotropy in 3D printing of reinforced thermoplastics using fused filament fabrication (FFF)** Professor Alois K. Schlarb | Technische Universität Kaiserslautern, Germany
13:30-14:00	**Titanium lattice structures fabricated by additive manufacturing: Mechanical behavior** Professor Lai-Chang Zhang | Edith Cowan University, Australia
14:00-14:30	**Vitrimer-like polymers and their applications** Professor Weimin Huang | Nanyang technological University, Singapore
14:30-14:40	**Photo**
14:40-17:00	**Paper Session**
Paper ID 7	**Design of hybrid microgels doped with fluorescent dyes and gold nanoparticles for photoacoustic imaging and photothermal therapy** Yu XIAO | University of Paris, France
MP507	**Influence of PET fibers on compressive strength, water absorption percentage and density of adobe** Melisa Evelyn Noa Huaman | Peruvian University of Applied Sciences, Perú
MP511	**Development of Characteristics and Thermal Properties of Ash Celadon Glazes in Thailand** Nophawan Dechboon | Rajamangala University of Technology Lanna, Thailand
MP512	**Network Relaxation and Cooperativity in Ion Conducting Polymers PEO-Li: An Analysis based on the BSCNF Model** Masaru Aniya | Kumamoto University, Japan
MP514	**SiC nanowire-Si3N4 nanobelt Interlocking Interfacial Enhancement of Carbon Fiber Composites with Boosting Mechanical and Friction Properties** Leilei Zhang | Northwestern Polytechnical University, China

MP502	**MECHANICAL, THERMAL AND SHAPE MEMORY CHARACTERIZATION OF A NOVEL EPOXY SHAPE MEMORY POLYMER** MAHESH UNNAM | Indian Institute of Technology Madras, India
2	**EFFECT OF GRAPHENE NANOPLATELETS ON TENSILE PERFORMANCE OF GFRP COMPOSITES** Shaik Shabberhussain | Indian Institute of Technology Madras, India
9	**Inverse method for estimation of thermophysical properties of a bimaterials** Yao KOUMEKPO | University of Lome, France
10	**LOCAL IDENTIFICATION OF THE ELASTICITY PARAMETERS OF HETEROGENEOUS MATERIALS BY THE FINITE ELEMENT MODEL UPDATING METHOD (FEMU)** Edo-Owodou AYELEH | University of Lome, France
12	**Synthesis of Copper (I) Oxide Powder by Solvothermal Method** Pusit Pookmanee | Maejo University, Thailand
MP517	**Effect of microstructure on the micromechanical properties of pyrolytic carbon of carbon/carbon composites** Li Wei | Northwestern Polytechnical University, China
5	**Design of bioactive chitosan nanocomposite films containing natural antimicrobials as a new active nanomaterial to control biological hazards** Tofa Begum | INRS-Armand Frappier Health Biotechnology, Canada
MP522	**Microstructure change during hot working of a two-phase titanium alloy with a lamellar colony structure** Weidong Zeng | Northwestern Polytechnical University, China

Keynote Speakers

Professor Bent F. Sørensen

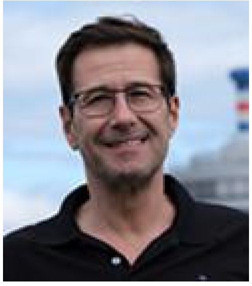
Technical University of Denmark, Denmark

Prof. Bent F. Sørensen is head of the section "Composites Analysis and Mechanics at the Department of Wind Energy, Technical University of Denmark. He got his MSc in 1988, his PhD in 1993 and obtained a Dr. Techn. degree in 2010, all from the Technical University of Denmark. He worked at the Materials Research Department of the former Risø National Laboratory from 1988 and transferred to DTU Wind Energy Department from 2012. From 2010 to 2017 he was overall centre leader for the Danish Centre for Composite Structures and Materials for Wind Turbines. His major research areas are fatigue and fracture and cohesive laws of composite materials and layered materials, dealing in particularly with theoretical and experimental research at the micro- and macroscale (micromechanics, crack bridging, mechanical properties of interfaces).

Professor Zhongwei Guan

Advanced Materials Research Centre, Technology Innovation Institute, UAE

Professor Zhongwe Guan is Executive Director of Advanced Materials Research Centre of Technology Innovation Institue in Abu Dhabi UAE. He is leading research groups on Energy Absorbing Materials and High Temperature Thermoplastic Materials. He has published more than 150 SCI papers in refereed international leading journals on composite structures, mechanical joints and polymeric structures. He is Chairman of the 5th International Conference on Computational Methods held in Cambridge in 2014. He is a member of Editorial Board of International Journal of Impact Engineering and International Journal of Applied Composite Materials. He has given more than 20 keynotes, thematic and plenary speeches in international conferences.



Professor Alois K. Schlarb

Technische Universität Kaiserslautern, Germany

Professor Schlarb currently holds the Chair of Composite Engineering (CCe) at the Technische Universität Kaiserslautern (TUK), Germany. He studied mechanical engineering at the University of Kaiserslautern, specializing in production engineering and company organization. After his graduation in 1984 he relocated to the University of Kassel, working as scientific assistant to Prof. Dr.-Ing. Dr. e.h. Ehrenstein. He was awarded a doctorate in 1989 for his thesis on polymer processing. From 1988 until 1989 he was also head engineer at the university's Institut fuer Werkstofftechnik. In the following 13 years Professor Schlarb held different positions in the industry, e.g. the polymer laboratory of BASF SE, Germany, as material scientist and project manager researching composites, last as Vice President and head of marketing, research and development with B. Braun Medical AG, Switzerland. In November 2002 Alois Schlarb was appointed to a full professorship for "Composite Materials" at the TUK and from 2002 to 2008 Chief Executive Officer of the Institut für Verbundwerkstoffe GmbH. Since 2018 Professor Schlarb also holds a visiting professorship at Qingdao University of Science and Technology, Qingdao, PR China. Professor Schlarb served as Spokesman of the Scientific Alliance of Polymer Technology (WAK) from 2009 - 2015 and as President of the Society for the Advancement of Materials and Processing Engineering SAMPE Deutschland e.V. from 2003 - 2015. He is member of the editorial boards for the Journal of Composite Materials, and Strain - International Journal for Experimental Mechanics, SAMPE-Journal, and the Journal of Polymer Technology.

He has given more than 200 presentations, has authored or co-authored more than 100 journal papers, edited or authored or co-authored more than 50 book chapters or books, and is listed in more than 50 patent applications as inventor. The focus of his research activities is on process-structure-property-relations and tribology of polymer based hybrid materials

Professor Lai-Chang Zhang

School of Engineering, Edith Cowan University, Australia

Laichang Zhang is a Professor of Materials Engineering and the Program Leader–Mechanical Engineering in the School of Engineering at Edith Cowan University (Perth, Australia). After awarded his PhD in Materials Science and Engineering at the Institute of Metal Research, Chinese Academy of Sciences, Prof. Zhang held several positions at The University of Western Australian, University of Wollongong, IFW Dresden and Technische Universität Darmstadt. His research interests include metal additive manufacturing, light-weight alloys, nanocrystalline materials and metallic glasses as well as nanomaterials. He has published more than about 300 referred journal papers with an H-index of 65 and 13000+ citations and 26 ESI Highly Cited Papers, and he has delivered 19 plenary/keynote/invited presentations at international conferences. Several his findings have been covered by public media outlets, such as by live TV on ABC News channel and on CCTV-4 (China Central TV) and by many mainstream newspapers and magazines. He has supervised 13 PhDs and 2 Masters by Research to completion. In addition, he also serves as Editor or Editorial Board Members many journals, e.g. Advanced Engineering Materials, Scientific Reports, Metals, Frontiers in Materials, Materials Science and Technology, etc.

Professor Weimin Huang

Nanyang technological University, Singapore

Dr Wei Min Huang has over 20 years of experience on various shape memory materials (alloy, polymer, composite and hybrid), he has published over 190 papers in journals, such as Accounts of Chemical Research, Advanced Drug Delivery Reviews, and Materials Today, and has been invited to review manuscripts from over 270 international journals (including Progress in Polymer Science, Nature Communications, Advanced Materials, and Advanced Functional Materials, etc), project proposals from American Chemical Society, Hong Kong Research Grants Council, etc, and book proposals from Springer, Elsevier and CRC. He has published two books (Thin film shape memory alloys – fundamentals and device applications, Polyurethane shape memory polymers) and is currently on the editorial board of over three dozen of journals.

Paper Session

Paper ID: 7
Title: Design of hybrid microgels doped with fluorescent dyes and gold nanoparticles for photoacoustic imaging and photothermal therapy

Abstract:
The development of hybrid microgels based on the integration of inorganic nanoparticles into polymeric particles has stimulated worldwide efforts in recent years due to their promising biomedical applications as smart therapeutic system and bioimaging agents1,2. In this talk, we describe an innovative modular strategy to obtain multifunctional smart hybrid particles based on the self-assembly of different building blocks (stimuli-responsive microgels, gold nanoparticles and fluorescent dyes) that could be compared to the assembly of lego® bricks (Fig. 1). The final hybrid networks display intense Raman signatures due the presence of the gold nanoparticles (Au NPs) trapped within the polymer matrix, which strongly enhance the vibrational signals of the dyes. The nanohybrids thus act as surface-enhanced Raman spectroscopy (SERS) tags for bioimaging. Moreover, the Au NPs trapped within the particles are also valuable light-to-heat plasmonic converters for biomedical hyperthermia. Besides, the combination of both Au NPs and dyes offers added-value property for photoacoustic imaging and PTT. Such hybrid particles not only combine the remarkable physico-chemical features of each component but also display synergetic properties that open promising prospects for a broad range of biomedical applications, including photoacoustic, Raman imaging and photothermal therapy.

Paper ID: MP507
Title: Influence of PET fibers on compressive strength, water absorption percentage and density of adobe

Abstract:
Adobe is a building material that has been used since ancient times, but is not as widely used as clay bricks or concrete for housing construction. However, this material will hardly cease to be used since it represents a lower cost for many families in the highlands. In addition, it uses a construction technique that has been passed down and improved from generation to generation. In view of this, the present work aims to improve the properties of adobe by using PET bottle fibers in its composition. A mechanical test and two physical tests were carried out for adobe with 0% (standard adobe), 2%, 4% and 6% PET fibers, where it was observed that the adobe with 6% PET fibers obtained the best results, since it increased the compressive strength of the adobe by 19%, reduced the absorption percentage by 12% and finally reduced the density by 16.4%. Therefore, the addition of PET fibers in adobe is recommended, as it contributes to improve its mechanical and physical properties. Additionally, it reduces pollution in streets, rivers, parks, etc. because it promotes the recycling of PET bottles.

Paper ID: MP511

Title: Development of Characteristics and Thermal Properties of Ash Celadon Glazes in Thailand

Abstract:

In this paper, we will study the development and comparison of characteristics and thermal properties of original celadon glazes and celadon glazes developed by adding black rice husk ash, Using Mae Rim black clay in Chiang Mai Province as raw material for the original celadon glaze (CG), including clay in the rice paddies, Kha wood ash and mixed wood ash. The raw materials for the development of celadon glazes formula were 14BR, 15BR, 20BR, 21BR, 27BR and 28BR, respectively. Using a triangular phase diagram system, Mae Taeng clay (MT), Kha wood ash (KWA) and black rice husk ash (BR) were used in the ratios of 40, 50, 60 and 70 wt.%, and using the red clay from Doi Saket, Chiang Mai as a coloring agent. Subsequently, the raw materials are ground and mixed to form a coating. Coated onto Mae Rim black clay test specimens. and fire the test specimen at 1250 °C in a reducing atmosphere. After that, the characteristics of the glazes after firing were tested, including crack, melt, flow, color appearance, and chemical composition. Thermal properties tests include the coefficient of thermal expansion and thermal shock resistance in temperature. The results showed that by comparing the original formula celadon glazes (CG) with the celadon glazes formula developed by adding black rice husk ash. crazing were reduced when adding more black rice husk ash. All formulations were melted at 1250 °C due to their CaO content of 55.0, 47.6, 41.0, 51.0, 47.9, 47.7 and 43.0 % respectively. From the chemical composition analysis with XRF, celadon glazes after firing in all formulas did not see any flow due to the content of SiO_2 being 28.0, 28.8, 35.4, 26.7, 28.3, 27.9 and 31.1% respectively. The appearance of glazes after firing was more greenish-yellow when rice husk ash was added when using a color analyzer. Because the amount of Fe_2O_3 up to 4.6, 9.3, 10.4, 8.2, 9.1, 5.9 and 6.0% respectively from Mae Taeng clay and Doi Saket clay. The chemical composition of celadon glaze consists of CaO as the main component, followed by SiO_2 and Fe_2O_3. The important thing is the chemical composition of the glazes was not found with lead and cadmium. The thermal expansion coefficient of celadon glazes at 25-1250°C decreased when adding more black rice husk ash. Finally, the percentage of strength loss after thermal shock temperature change was CG > 20BR > 21BR > 27BR > 28BR > 14BR > 15BR, respectively, using the Celadon Pottery Community Standards Test. (MorChor. 245/2013).

Paper ID: MP512

Title: Network Relaxation and Cooperativity in Ion Conducting Polymers PEO-Li: An Analysis based on the BSCNF Model

Abstract:

The understanding of fundamental materials properties is a key factor for the development of functional materials. Some years ago, it has been reported that the fragility in poly(ethylene oxide)-based Li^+ ion conductors decreases with the Li^+ ion content. The behavior was considered as unexpected and the origin unclear. In the present study, it is shown that the Bond Strength-Coordination Number Fluctuation (BSCNF) model of structural relaxation developed in our group provides an explanation to the observed behavior. The analysis based on the model indicates that the degree of cooperativity or the number of correlated structural units involved in the network relaxation decreases with the Li^+ ion content.

Paper ID: MP514

Title: SiC nanowire-Si3N4 nanobelt Interlocking Interfacial Enhancement of Carbon Fiber Composites with Boosting Mechanical and Friction Properties

Abstract:

Carbon fiber composites composed of carbon fiber and pyrolytic carbon (PyC) matrix have greatly potential application in brakes of aircrafts, where the combination of high mechanical strength and excellent friction properties are required. In this work, two-component silicon-based interlocking enhancement were designed and constructed into carbon fiber composites for boosting the mechanical and friction properties. Specially, silicon carbide nanowires (SiCnws) and silicon nitride nanobelts (Si3N4nbs) could form interlocking architectures, where SiCnws are rooted firmly on carbon fiber surface in radial direction and Si3N4nbs integrate PyC matrix with carbon fibers together via networked shape. SiCnws-Si3N4nbs not only refine PyC matrix but also promote the bonding of the fiber/matrix interface and the cohesion strength of PyC matrix, thus enhancing the mechanical properties and friction properties. Benefitting from SiCnws-Si3N4nbs synergistic effect and interlocking enhancement mechanism, the interlaminar shear strength and compressive strength of carbon fiber composites increase by 88.41% and 73.40%, respectively. In addition, the friction coefficient and wear rate of carbon fiber composites decreased by 39.50% and 69.88%, respectively. This work could open up an interlocking enhancement strategy for efficiently fabricating carbon fiber composites with promoting mechanical and friction properties that could be used in brakes of aircrafts.

Paper ID: MP502

Title: MECHANICAL, THERMAL AND SHAPE MEMORY CHARACTERIZATION OF A NOVEL EPOXY SHAPE MEMORY POLYMER

Abstract:

In past 3 decades a large number of shape memory polymers are available for various applications. This paper is aimed to produce a novel epoxy polymer by combining an epoxy base polymer Diglycidyl Ether of Bisphenol-A (DGEBA-Araldite LY556) and Polypropylene Glycol Diglycidyl Ether (PPGDE). The mechanical, thermal and shape memory characterization of material is done. It was found that the tensile strength of the material is reduced linearly with increasing the percentage of PPGDE. The elongation at break of the material is increased from 10% to 60% with 25% addition of PPGDE. The glass transition temperature of the material decreases linearly with increasing PPGDE percentage. D-70-P-30 (DGEBA-PPGDE) combination of the material is chosen for shape memory characterisation as its glass transition is above and within the vicinity of room temperature which is the pre-requisite for cold programming. The material shows good shape memory properties such as shape fixity and shape recovery.

Paper ID: 2

Title: EFFECT OF GRAPHENE NANOPLATELETS ON TENSILE PERFORMANCE OF GFRP COMPOSITES

Abstract:

The carbonaceous nanofillers such as graphene nanoplatelets (GN) due to their unique properties have been increasingly used as nanofillers to improve the mechanical properties of FRP composites. In the present study, unidirectional glass fiber reinforced polymer (GFRP) composites and GFRP composites with graphene nanoplatelets (GN-GFRP) are fabricated using vacuum bag process and hand layup method. The percentage of GN added in GN-GFRP composites is 0.1% and 0.5% in case of hand layup method and 0.5% in case of vacuum bag process. The specimens are tested under uniaxial tension and three-point bending to study the effect of GN on the tensile and flexural performance of GFRP composites. In case of composites fabricated using hand layup method, the tensile strength of GFRP composites increased by 35.8% and 40.4% with the addition of 0.1% and 0.5% GN respectively. The tensile modulus of GN-GFRP composites with 0.5% GN decreased by 11.8% compared to GFRP composites. The flexural strength of GN-GFRP composites with 0.1% and 0.5% GN are found to have increased by 6.5% and 5.3% respectively compared to GFRP composites. The flexural modulus of GN-GFRP with 0.1% GN increased by 11% and the same for GN-GFRP with 0.5% decreased by 8.2% compared to GFRP composites. The tensile strength and modulus of GN-GFRP composites fabricated using vacuum bag process decreased by 24.4% and 7.7% respectively compared to GFRP composites. Scanning Electron Microscope (SEM) investigation reveals that poor adhesion of resin with the fibers caused delamination in GN-GFRP composites fabricated using vacuum bag process resulting in reduction of tensile properties.

Paper ID: 9

Title: Inverse method for estimation of thermophysics properties of a bimaterials

Abstract:

The aim of this study is to identify simultaneously the thermal conductivity tensor and the volume heat coefficient of a bimaterial(checkerboard) whose heat conduction obeys Fourier's law. This approach is validated by numerical simulation. The simulated temperature fields are obtained by the direct resolution heat conduction solved numerically by the finite element method formulation. To identify parameters, an inverse method is developed by using the finite element temperature approach (FEU-T) model fitting method based on the Levemberg-Marquardt algorithm. We validated the numerical procedure by using noiseless temperature fields at different time and space steps. The influence of the noise on the temperature fields is also studied and shows the efficiency of the inverse method. The results show that this procedure is not very sensitive to the number of elements (or space steps) and the number of time steps.

Paper ID: 10

Title: LOCAL IDENTIFICATION OF THE ELASTICITY PARAMETERS OF HETEROGENEOUS MATERIALS BY THE FINITE ELEMENT MODEL UPDATING METHOD (FEMU)

Abstract: This work is subjected to an identification of elasticity properties of a heterogeneous material. After obtaining the strain fields we created experimental data in an artificial way. A re-calibration of the data and simulated data is done based on the principle of the finite element model updating (FEMU). The minimization of the cost function obtained by FEMU in the inverse problem is done by Newton type algorithms. A complete study has been done by studying the sensitivity of the identified values with respect to the refinement of the mesh and with respect to the level of disturbance.

Paper ID: 12

Title: Synthesis of Copper (I) Oxide Powder by Solvothermal Method

Abstract: Copper (I) oxide (Cu2O) powder was synthesized by solvothermal method. Copper (II) sulphate (CuSO4.5H2O), sodium hydroxide (NaOH) and ethanol (C2H5OH) were used as the starting precursors. The final pH of mixed solution was adjusted to 14 by 8M NaOH and treated at 150 °C for 6h. The red fine powder was obtained and dried at 100 °C for 1h. The phase was characterized by X-ray diffraction (XRD). A single phase of cubic structure was obtained without calcination steps. The morphology, particle size and element composition were investigated by scanning electron microscopy (SEM) and energy dispersive X-ray spectrometry (EDXS). The particle was irregular in shape with the average of particle size of 0.40 m. The chemical compositions showed the characteristic X-ray energy of copper (Cu): K = 8.047 keV, K = 8.905 keV, L = 0.929 keV, L = 0.950 keV and oxygen (O): K = 0.525 keV, respectively. The functional group was determined by Fourier transform spectrophotometry (FTIR). The wavenumber at 626, 780 and 1125 cm-1 were corresponded to vibration of Cu-O stretching of Cu2O powder.

Paper ID: MP517

Title: Effect of microstructure on the micromechanical properties of pyrolytic carbon of carbon/carbon composites

Abstract:

In order to investigate the effect of microstructural on the micromechanical behavior of pyrolytic carbon (PyC), the microstructure of high texture (HT) and medium texture (MT) PyC after heat treatment from 1600 °C to 2450 °C were studied comparatively. The micro-indentation test was performed to reveal the micromechanics. In terms of microstructure, after heat treatment, the HT matrix was delaminated into many nano-layers accompanied by multiple microcracks, while the MT matrix was delaminated into micro-layers including lots of cracks. Meanwhile, numerous nanopores were observed in the MT matrix after heat treatment at 2450 °C. The interfaces of two textures became smoother and wider, and the width of HT interface was narrower than that of MT at different heat treatment temperatures. Moreover, the increasing tendency of the basal plane length (La) and the height of layered stacking (Lc) of HT were greater than those of MT. The micro-indentation results showed that the indentation depth of HT was always deeper than that of MT, and the corresponding micro-hardness and elastic modulus of MT were greater than that of HT after different temperature treatment.

Paper ID: 5

Title: Design of bioactive chitosan nanocomposite films containing natural antimicrobials as a new active nanomaterial to control biological hazards

Abstract:

A Central Composite Design was used to develop reinforced chitosan (CH)-based films with cellulose nanocrystals (CNCs). Two bioactive formulations (AF-1 and AF-2) were developed by combining essential oils (EOs) and citrus extracts (CEs) using checkerboard method. An oil-in-water emulsion of AF-1 and AF-2 (2% w/w) were prepared using 2% Tween 80 (w/w) and 96mL of water and passed through high pressure microfluidizer for nanoemulsions. The AF-1 and AF-2 were optimized and stabilized at 8000psi (2nd cycle) and 15000psi (3rd cycle), respectively. The optimized pressure increased the encapsulation efficiency of AF-1 and AF-2 from 30-77.4% and 11.5-78.6%, respectively. A quantity of 0.05-0.2% (w/w) cellulose nanocrystals (CNCs) suspension was added to 2% (w/v) chitosan solution followed by 0.5% (w/v) polyethylene glycol (PEG). The optimized nanoemulsion of AF-1 and AF-2 was added to CH solution at different concentrations (0.25-1%). Results showed that the AF-1 and AF-2 nanoemulsion based CH-CNC films showed strong microbicidal and insecticidal activity against Escherichia coli, Salmonella Typhimurium, Aspergillus niger, Penicillium chrysogenum, Mucor circinelloides, and Sitophilus oryzae (rice weevil). The reinforcement of CNC in CH matrices significantly improved the mechanical properties and water vapor permeability of the nanocomposite film. CNCs also significantly slowed the release of active compounds from CH nanocomposites (ranging between 76-53%). A vapor phase assay of the CH-based nanocomposite films that were loaded with nanoemulsions of AF-1 and AF-2 showed significant microbicidal and insecticidal activity against E. coli, S. Typhimurium, A. niger, P. chrysogenum, M. circinelloides, with their growth reduced by 60-80%, and high insect mortality which was increased by 91 and 100% at day 10 compared to controls. The CH-CNC film containing nanoemulsions of AF-1 and AF-2 could help prevent the growth of microorganisms in food and increase the shelf-life.

Paper ID: MP522

Title: Microstructure change during hot working of a two-phase titanium alloy with a lamellar colony structure

Abstract:

The effect of hot working on microstructure evolution was investigated for the two-phase titanium alloy with a lamellar colony structure. For this purpose, material was isothermally forged at high-temperature and subsequently heat treated for different times. The principal features of microstructure evolution were found to be strain and temperature dependent. Microstructure evolution during deformation included the rotation of alpha lamellae towards the metal flow direction. The orientation distribution of alpha lamellae changed from the two symmetrical peaks to the single one with the increasing strain. The angle (θ) in the single peak position was about 90°. Additionally, Static globularization is major characteristic of microstructure evolution during heat treatment. The static globularization kinetics is sensitive to the amount of strain prior to heat treatment, heat treatment temperature and time. Globularization process is accelerated with the amount of strain and heat treatment temperature increase. Globularization fraction increases fast at first and then slow down with the increase of heat treatment time. The amount of strain prior to heat treatment mainly influences the initial stage of heat treatment and plays a supporting role in the latter stage. Heat treatment temperature has an important role during the whole heat treatment process. Static globularization kinetics is found to be less dependent on deformation temperature. The theoretical models of boundary splitting and termination migration were proposed to model the static globularization behavior.

Poster Session

Paper ID: 4

Title: A brief overview on the extraction of cellulose from medicinal plants for advanced applications

Abstract:

For over a thousand years, cellulose has been known as a polysaccharide that is readily available in nature. It is branded as a main constituent of the cell wall. Since the cell wall is produced by all plants, it is probably the amplest organic compound on Earth. The extraction of cellulose from medicinal plants is becoming a topic of interest. This is because compounds extracted from medicinal plants including cellulose are used as additives in pharmaceutical, neutraceutical, toxicology, and other chemical industries, for treating syphilis, kidney disorders, wound healing, ulcers, skin rash, gonorrhoea, and piles. Also, cellulose has been identified as useful for reinforcement and load-bearing purposes in composite materials due to its intrinsic stiffness and a high degree of crystallinity. However, the process of extracting cellulose, as well as the extent of the needed purity strongly depends on the application of the used polymers. This contribution focuses on medicinal plants as potential sources of bioactive cellulose.

Paper ID: MP513

Title: Pellet-Based Additive Manufacturing (PBAM) of Styrene-ethylene-butylene-styrene (SEBS) elastomer

Abstract:

In the present work, a vertical micro-extrusion system for Pellet-Based Additive Manufacturing (PBAM) developed by our research group was used for the additive manufacturing of flexible parts, using styrene-ethylene-butylene-styrene (SEBS) polymer.

The micro-extrusion system uses a single screw to feed the material and move it through the barrel and where it is melted and pushed through a die. This mechanism allows the immediate use of a wider range of materials compared to the traditional fused filament fabrication (FFF) where the material that is fed in the form of a continuous filament can incur in failure caused by buckling or brittle fracture. A numerical model developed by our research group [1] is also presented to support the selection of the best processing parameters, increasing efficiency and reducing degradation. The accuracy of the model's prediction for the SEBS is experimentally validated through the comparison of the predicted melting profile and the experimental results of a screw-freezing experiment.

The extruder is then used for the additive manufacturing of tensile test specimens, for which the mechanical properties were compared to those of injection molded samples.

Finally, one of the samples was embedded in epoxy resin and a high-resolution image of its cross-section was acquired by optical microscopy to investigate the quality of the manufacturing process. The area of the voids present in the cross-section was evaluated through an image processing software. The micro-extruder was able to successfully complete the manufacturing of complex geometries, but the presence of voids in the cross-section of the sample suggests that further optimization of the process is necessary.

Paper ID: MP516

Title: Evaluation of the properties of Olive Husk flours and Prickly Pear Seed flours and their Poly-lactic acid-based Composites

Abstract:

PLA is a thermoplastic polymer made from lactic acid and has mainly been used for biodegradable products; it can also be used as a matrix material in composites. In this work, Olive Husk flours (OHF) and Prickly Pear Seed flours (PPSF) were used as reinforcements of poly lactic acid (PLA) matrix. Initially, the physico-chemical and thermal characterization of its fibers were studied and compared. Then, the composite materials studied were manufactured with a twin-screw extruder having a fiber content of 10%, 20% and 30% by weight; the material properties have been studied and compared. The characterization of these two fibers showed that the quantity of cellulose is greater in the OHF and that the latter is more thermally stable since it has a higher degradation temperature compared to the prickly pear seed (GFB). For the composite material, the PLA /OHFs (F(A)) are the most responsive in thermal and mechanical behaviors since their degradation temperatures are closer to pure PLA and the tensile modulus is higher compared to the PLA/PPSFs (F(B)) composites.

Paper ID: 13

Title: Modeling and validation of AM metals/CFRP joints based on patterned surfaces and fibers engagement

Abstract:

The fabrication of co-cured metal/CFRP joints offers some relevant advantages as the elimination of adhesives and the simplification of building process. In this view, the additive manufacturing (AM) of metal parts is suitable for expanding the potentialities of co-cured AM metal/CFRP joints where patterned surfaces are introduced. This paper presents a methodology to fabricate the joint, based on matrix patterns of 3D features on the metal surface, which is able to improve the polymer matrix adhesion and to provide carbon fibers engagement. Both FEM simulations and experiments show significant enhancement of the global mechanical strength.