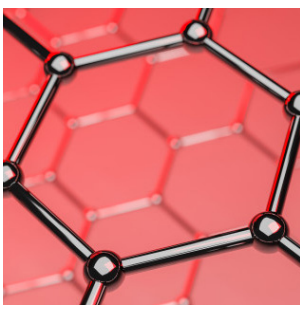
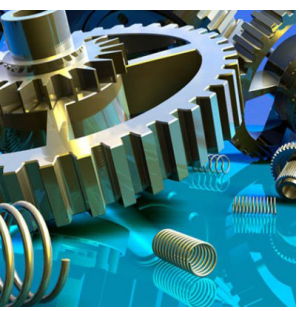
Keynote Forum
October 07, 2019

Material Science 2019





3rd International Conference on

Materials Science and Engineering

October 07-08, 2019 | Frankfurt, Germany

Rajan Sen

University of South Florida

Durability testing of FRP: The way forward

The durability of fiber reinforced polymers (FRP) has been the subject of continuing research for over 65 years. Initial studies focused on aerospace applications; later, emphasis shifted to infrastructure. The reliability of adhesive joints used in aircraft construction has resulted in increased use of composites. Comparable progress in the infrastructure sector is lagging due in part to the absence of a common durability testing protocol compounded by the inherent variability of wet lay-up applications using ambient cure resins.

Since durability evaluates performance of bonded assemblies, the effects of surface preparation, the interface, adhesive, the curing regime and exposure are automatically considered. Among researchers, there are significant variation in these parameters. This is a major reason for the relative lack of progress. For example, immersion in distilled water used for evaluating FRP-steel durability is taken from a 1960's pass / fail protocol intended to screen materials and has no bearing to actual service conditions of bridge repairs.

This presentation re-visits durability testing protocols used in research. The intent is to critically review exposures that were evaluated with a view to defining a common testing protocol for consideration by all researchers. Commonality in test parameters will enable findings from disparate studies to be aggregated and used to develop predictive models correlating test results to service performance obtained from full scale demonstration projects. Increased confidence in long term durability of adhesive joints will promote greater FRP use.

Speaker Biography

Rajan Sen is Professor of Structural Engineering at USF where he held the Samuel & Julia Flom Chair and joint appointments in Architecture & Engineering. As NAS Jefferson Science Fellow at US Department of State, Washington DC he served as delegate to UNISDR at UN Geneva, on NSTC's Disaster Reduction/Infrastructure subcommittees and was a contributing member of the Science Coordination Working Group's Presidential Hurricane Sandy Task Force. On Editorial board of ASCE's Composites for Construction, he was Conference Chair for FRPRCS 10, served on several NSF and NAS review panels, has been NSF delegate to conferences worldwide, authored over 250 publications, edited two books, holds 3 patents, has been active in FRP field research on durability and marine corrosion repair funded by NAS, NSF, Army Corp of Engineers and FDOT. A member of ACI 440 and TRB AFF80 committees, he previously worked on design standards at BES Department of Transport, London, UK. An honor graduate of IIT KGP, he holds graduate degrees in Civil Engineering from University of British Columbia, Vancouver, Canada and SUNY, Buffalo. He is Fellow of ACI & ASCE, Distinguished Faculty Fellow at Office of Naval Research CISD, and registered professional engineer in Florida.

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Alex Patist

Bolt Threads, USA

Better materials for a better world: Silk without spiders and leather without cows

Nature has created many natural protein polymeric materials suitable for use as fibers – like spider silk. Bolt Threads has developed a molecular biology platform to mimic and/or tune the properties and inherent environmental compatibility of these materials and manufacture them via large-scale fermentation. Our platform includes genetic-level control over the amino acid sequence, allowing us to fine tune the polymer processing windows and functional material properties. Today, Bolt Threads is capable of producing a recombinant spider silk protein at commercial scale and spin this material into filament and staple yarns. Bolt Threads filaments exhibit spider silk biomimicry and can be generated with high consistency and at large volumes. This first fiber demonstrates the baselined capability of Bolt Thread's designer protein polymer pipeline. The mission of Process Development is to continue to optimize and deploy scalable, economically viable processes for the production of the natively-inspired bio-derived materials with sustainability, performance, and market advantages. This session will describe our approach used to accelerate the launch of our first commercial products: 1. A recombinant spider silk protein which we spin into filament and staple yarns, and 2. Mylo™ a mycelium leather. A little more about

Bolt Threads: Bolt Threads is a vertically integrated company driven by 100+ dynamic scientists, engineers, artists, and operations specialists. At Bolt, our endeavors include molecular biology and materials science R&D, polymer production, fiber manufacturing, product development, marketing, merchandising, and direct to consumer sales. Bolt Threads operates direct to consumer through Best Made Co. and partners with well-known brands such as Stella McCartney and Patagonia.

Speaker Biography

Alex Patist has over 20 years of experience in directing new product, process development, and scale-up in the food, nutraceutical, biochemical & biofuels industries. Since 2017, he took on the role of VP of Process Development & Manufacturing at Bolt Threads. Before Bolt, he spent 4 years at Genomatica in San Diego, a leading biotech innovator for the chemical industry. He has been a catalyst in mainstreaming a whole process approach to deliver economic advantaged bioprocesses. Previously, he was at Cargill R&D in Minneapolis. During his tenure as Director of Technology he worked with major partners such as Pepsico, Coke and Kraft taking ideas from concept to realization (for example the high intensity sweetener Truvia®). Originally from the Netherlands, he has a BS from Hogeschool Utrecht, MS from TU Eindhoven and a Ph.D. from the University of Florida, all in Chemical Engineering.

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Horst D Peters

Aluminium Technology Consultants (ATC), Germany

Development of high temperature tube digestion technology for bauxite

The Bayer process for leaching bauxite with caustic soda to produce aluminum oxide and the Hall-Héroult process for the extraction of aluminum using fused-salt electrolysis were decisive in providing the basis in 1888 for the production of aluminum on an industrial scale. Aluminum production is still based on these processes today. In the beginning, the introduction of these technologies was somewhat slow; there was a lack of suitable production equipment and a lack of markets for aluminum. Increased aircraft production resulting from the First World War created new demand and forced production to follow suit. This article describes the development of alumina production technology. The Tube Digestion Technology for processing monohydrate bauxites at high-temperatures, which Vereinigte Aluminium Werke A.G. (VAW) brought into industrial production as long ago as 1956, is now used in numerous modern alumina plants.

Speaker Biography

Horst D Peters studied Business Administration and Economics in Hamburg and Göttingen as well as Mining in Berkeley, USA, and Clausthal. He was awarded the degrees of Dipl.-Vw. and Dipl.-Kfm. and subsequently graduated as he began his professional career at Preussag AG Metall in Goslar and Hannover. From there he moved to Kaiser Aluminium & Chemical Corp. in Oakland, USA, where his fields of activity were bauxite mining in Jamaica and investment control at the alumina plants and aluminium smelters in the USA. In 1977 he started working for VAW Aluminium in Bonn. From 1992 to 2003 he was managing director of VAW Aluminium-Technologie GmbH. He then became Vice President Aluminium at EN+ Group Ltd. in London and Moscow as well as being a board member at Rusal from 2004 to 2008. He now heads the consulting firm ATC (Aluminium Technology Consultants).

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Fused deposition modelling of acrylonitrile styrene acrylate and related mechanical performance

Fused Deposition Modelling (FDM) is among the affordable additive manufacturing techniques used to to process complex three-dimensional designs with weak dependancy on the production tool. Well-known feedstock materials such as ABS, PLA were successfully printed using FDM. Despite the increasing research effort directed towards FDM, there is still a gap in the literature about the printability of some materials such as the one considered in this study, namely acrylonitrile styrene acrylate (ASA). The effect of FDM processing conditions is considerted on the thermal and mechanical properties of ASA. The feedstock material is characterised using differential scanning calorimetry and tensile testing. Infra-red measurements are used to capture the thermal signature of the ASA filament during laying down process for various printing temperatures. Both X-ray micro-computed tomography and mechanical testing are undertaken on printed ASA as a function of the process conditions. Finite element computation is considered to preodict the perfromance of the printed material and to gain further insights on the deformation mechanisms. The experimental results show that the printability of ASA is reduced to a narrow range of printing tempratures. A loss of mechanical performance is also observed, which is found dependant on the printing temperature. The numerical results demontrate that the observed mechanical perroamnce is reflected by the nature and extent of defect generated by the processing.

Speaker Biography

Guessasma S is a mechanical engineering scientist, a by-fellow of the Churchill college, University of Cambrige, UK, and a high-end foreign expert in China. He is presently a senior scientist at INRA (France) conducting a research activity in the field of additive manufacturing of biosourced materials. He has a key interest on hot topics in mechanical engineering, processing and materials science. He has several contributions related to the microstructural interpretation of material performance, mechanical modelling, image analysis, and in-situ experiments. He published over 120 papers in different research fields.

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Xiping Guo

Jing Li

Northwestern Polytechnical University, China

Microstructure and high-temperature oxidation-resistant performance of four silicide coatings on Nb-Ti-Si based alloy prepared by pack cementation process

The microstructure and high-temperature oxidation-resistant performance of four silicide coatings prepared respectively at 1250°C for 8 h by pack siliconizing process, Si-Y co-deposition process and Si-Al-Y co-deposition process (with different Al contents in the packs) on an Nb-Si based alloy were revealed. The results showed that the purely siliconized coating was composed of a $(Ti,Nb)5Si_3$ ouer layer, a $(Nb,X)Si_2$ (X represents Ti, Cr and Hf elements) middle layer and a $(Ti,Nb)5Si_4$ inner layer. A thicker and more compact double-layer structure including a $(Nb,X)Si_2$ outer layer and a $(Ti,Nb)5Si_4$ inner layer was observed in the Si-Y co-deposition coating. In addition, a higher Y content (about 0.34 at. %) in the outer layer of the Si-Y co-deposition coating was obtained, while the Y content was only about 0.06 at. % in the purely siliconized coating. The Si-Al-Y co-deposition coating possessed a $(Nb,X)Si_2$ outer layer, a $(Ti,Nb)5Si_4$ middle layer and an Al, Cr-rich inner layer. A suitable addition of Al powders (5 wt. %) in the packs was beneficial to thicken the $(Nb,X)Si_2$ outer layer, while a sharp reduction in the coating thickness was found when excess Al powders (10 wt. %) was added in the packs. The thickness and microstructure of the scales formed on above four coatings upon oxidation at 1250°C for either 5 h or 100 h were comparatively investigated. The oxidation resistance of these silicide-type coatings was notably enhanced by the addition of Y and Al. The Si-Al-Y co-deposition coating prepared with 5 wt. % Al powders in the pack, possessed the best oxidation resistance due to its optimum dense and continuous scale and compact coating remained.

Speaker Biography

Xiping Guo has completed his PhD in 1992 from Northwestern Polytechnical University, China. He is the professor of Northwestern Polytechnical University, China. His research interests are in the fields of ultrahigh temperature structural metallic materials, oxidation resistant coating technologies and directional solidification techniques. He has over 260 publications that have been cited over 1300 times, and his publication H-index is 20.

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Reza Javaherdashti

Paracorrosion Consultants, Australia

On the role of corrosion (knowledge) management for a better materials selection

Corrrosion is thermodynamically favoured, unstopable chemical reaction that has very seriuos adverse economical and ecological impacts. There are five methods by which corrosion can be treated: (1) use of chemicals such as corrosion inhibitors and biocides, (2) implementation of cathodic/anodic protection, (3) application of coatings, (4) modification of the design of the part to make it less vulnerable to the corrosive eenvironmnet and (5) materials selction in the sense that materials with better corrosion resistance will take the place of more susceptibe ones.

There are basically two parrallel approaches to deal with corrosion: One approach which is known as Corrosion Management (CM) deals with the risk of corrosionin purelytechnical and engineering terms while Corrosion Knowledge Management (CKM) is a management approach to be implemented by decision making managers. While all the five methods to manage corrosion are more or less costly, materials selction is with no doubt the most expensive of the five becuae it often involves replacing the cheaper material with lower corrosion resistance with the one that is very expensive owing to its improved mechanical and chemical properties. The difference in the cost could be so huge that the overal cost of the project could become doubled or tripled in terms of CAPEX (Capitial expenditure). Increasing the CAPEX of a project is not an easy issue to handle unless the project management is educated and assured that the OPEX (operation expenditure) will be low during the life cycle of the part. This is often a management decision rather than a purely engineering ratification act and for that a CKM mentality about the engineering risk of corrosion in terms of its “Risk” and “Cost” must exist.

A company in which the top management is aware of the risk of corrosion (in engineering terms) and cost of corrosion (in managerial terms) will be more prone to accept the risk of a higher CAPEX project in terms of materials selection to minimise the consequenet OPEX than a company that is considering corrosion something that” can be handled anyway” down the line of the life cycle of the asset. In this presentation, after a quick review of some economical and environmental aspects of corrosion, the main framework of CKM and its four principles will be introduced and discussed.

Speaker Biography

Reza Javaherdashti holds a double degree in Materials Science and Metallurgical Engineering. In addition to being an internationally renowned expert on microbial corrosion, He has several internationally referenced books and papers on the subject. He has over 20 years of field and academic experience as both a consultant and a researcher. He is the first scientist who has applied Fuzzy logic in prediction the risk of microbial corrosion successfully. While as an engineer corrosion is his passion, as a manager he has grown interest in studies related to the cost of corrosion. He theorised and formulated Corrosion Knowledge Management (CKM) for managers and was the first who applied Future Studies to present a Futuristic model for managers that had corrosion as its integral element.

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October 08, 2019

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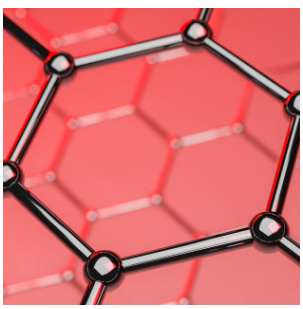

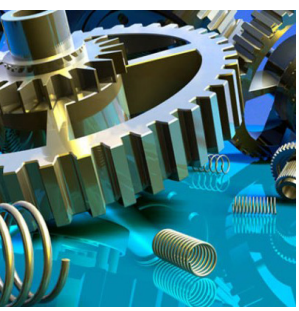

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Ronkainen Helena

VTT Technical Research Centre, Finland

Modeling approaches for tribological applications

The use of computational modelling and simulation offers new understanding of material responses in tribological contacts. Modeling of changes in material due to surface loading, and calculations of stresses and strains help to understand the mechanisms that result in e.g. surface cracking, wear particle formation and wear. The multi-scale modelling of metal matrix composite coating generated using microstructural material model allowed evaluation of stresses, strains occurring under tribological loading. Modeling also enabled the estimations of damage tolerance of the coating, and provided predictions on the effect of microstructural features on wear resistance in abrasive and erosive conditions. Good agreement was found between the tribological experiments and modeling. The simulation results showed that the microstructural modelling is a practical tool for the digital materials design of wear resistant materials. Modeling can also be applied to generate digital twins of tribological tests. Combining the modeling with experimental results on laboratory scale tests and on the larger component scale, a Lab-to-Field upscaling tool will be generated to bridge the gap between the model and larger scale component tests. By modeling based Lab-to-field up-scaling tool it will be possible to decrease the number of expensive component and higher scale experiments and thus achieve more cost-effective materials up-scaling for tribological applications.

Speaker Biography

Ronkainen Helena is a Principle Scientist at VTT Technical Research Centre of Finland. She obtained her M.Sc. degree in Mechanical Engineering and Dr. (Tech) degreed in Materials Science from the Helsinki University of Technology (at present Aalto University). She has worked in the field of tribology over 30 years and carried out tribology research to provide solutions for energy and material efficiency and she has more than 90 papers in peer-reviewed international scientific journals. The main areas of interest have been surface coatings and materials to provide low friction and high wear resistance for various applications, including the use of computer modeling and simulation to increase the understanding of wear phenomena. Her current research interest has been the wear resistance of polymers, particularly the abrasive wear performance of polymers.

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Notes:

Aguiar J

Cunha S

University of Minho, Portugal

Durability of cement mortars with incorporation of phase change materials

Currently, it is necessary to study and develop constructive solutions with high durability, in order to deacrese the environmental negative impacts and maintenance costs of buildings. The development of functional construction materials to increase the energy efficiency of buildings is now an effective way to contribute to a more sustainable development. The high energy consumption throughout the world is one of the main problems of the modern society. Thus, the development of mortars with incorporation of phase change materials (PCM) is a very promising technique for the improvement of social, economic and environmental habitability conditions.

The PCM have the thermal regulation capacity due to their ability to absorb and release energy to the environment, allowing decrease the energy buildings consumption, gas emissions to the atmosphere, environmental negative impacts and increase the energy efficiency of buildings. The durability study depends on the costruction materials application. The exterior solutions have more requirements compared to the interior solutions, since they are more exposed to weather conditions. However, the interior construction solutions must also be extensively studied regarding to their durability, more specifically their behavior at low and high temperatures. Thus, it is important to evaluate the behavior of PCM mortars when submitted to the freze-thawn cycles (-18ºC - 20ºC) and high temperatures actions (200ºC, 400ºC and 600ºC). The main results obtained with this study allow to conclude that the incorporation of PCM leads to identical behavior to mortars without PCM.

Speaker Biography

Aguiar J has completed his PhD at the age of 30 years from University of Minho, Portugal. He is asssociate professor at the University of Minho, Portugal. He has over 250 publications that have been cited over 800 times, and his apublication H-index is 17.

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Notes:

Ioannis Karapanagiotis

University Ecclesiastical Academy of Thessaloniki, Greece

Nanostructured biomimetics surfaces of extreme wetting properties

Materials of extreme wetting properties offer new perspectives in the design and preparation of water-repellent, oil-repellent, self-cleaning, dirt-free, anti-adhesive, anti-icing, anti-microbial materials which can have numerous applications in various sectors from the electronics, automobile, aircraft, construction and medical industries, to membrane filtration and water harvesting technologies, coating manufacturers and preservation of the cultural heritage. Extreme wettabilities, with very high or low static water contact angle and hysteresis, are typically observed on micro/nanoscale binary structured surfaces which can be found in nature, such as for instance, in the leaves of lotus and rice, in the petals of rose, in the feet of gecko and the feathers of duck.

In the last two decades enormous effort was devoted to understand the relationship between the natural binary structures and wettability and to fabricate artificial surfaces of extreme wetting properties thus mimicking nature and producing biomimetics surfaces. In this paper the relevant fundamental concepts and progress will be discussed and key strategies to achieve extreme wetting properties will be presented. Emphasis will be placed on superomniphobic coatings which can be deposited on large scale surfaces and can be therefore used for the protection and preservation of the cultural, including buildings of architectural charm and historical significance. The present investigation also encompasses evaluation of other properties of the multifunctional coatings such as, for instance, their durability and transparency.

Speaker Biography

Ioannis Karapanagiotis is an Associate Professor of the Department of Management and Conservation of Ecclesiastical Cultural Heritage Objects, University Ecclesiastical Academy of Thessaloniki, Greece. He has obtained his Ph.D. in Materials Science and Engineering from The University of Minnesota, United States, and his Diploma in Chemical Engineering from the Aristotle University of Thessaloniki, Greece. His research interests are diverse ranging from wetting phenomena, interfacial engineering and nanomaterials to the development of novel methods for the protection/conservation of the cultural heritage and the characterization and analysis of cultural heritage materials which are found in historic monuments, paintings, icons, textiles, manuscripts. He serves as a member in Editorial Boards and reviewer in several journals (more than 90), and he has published multiple research papers (more than 140) in peer reviewed journals, books and conference proceedings.

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Notes:

Ioury Timoshkov

Qilong Gao, Gennadi Govor, Dmitry Grapov** and **Alexander Vetcher

Belarus State University of Informatics and Radioelectronics, Republic of Belarus

Soft magnetic composites: Physical fundamentals and technical applications

The fourth revolution of the industry is powered by a wide range breakthrough, new technology, innovative ideas and creative activities. All these things were naturally born, mostly, by the interdisciplinary science and technology. Soft magnetic composites are the bright example of the different technologies integration to get final commercial products with enhanced properties. In the report we systematized the methods, technologies and structures of this type of heterogeneous materials with soft magnetic properties, pros and cons are discussed. The main mechanisms of magnetization reversal of such structures are reviewed, as well as the effect of inhomogeneities on the main magnetic properties: magnetic induction, permeability, coercive force, and loss. The basic requirements to these materials for practical use in advanced electric machines, electric vehicle motors, electromagnetic micromotors and generators, magnetic memory, and MEMS are analyzed.

We developed the technology of iron powder treatment to create the nanometer coating on the surface of each particle. The final magnetic details are produced by technology of powder metallurgy. Unique specific parameters of a soft magnetic composite material were achieved: magnetic induction of saturation – 2.1 T, working frequency range - up to 1 MHz, permeability – up to 1000, total loss – 8 W/kg, Curie temperature - above 800C. These allow to produce machines with the large number of poles and high frequency of switching, thus improving specific mass and size parameters. LIGA-like MEMS technology was developed to produce hybrid stepper micromotor based on soft magnetic composites.

Speaker Biography

Ioury Timoshkov focused his scientific activities on the development of heterogeneous materials to improve mechanical and physical properties. In particular, his experience spans technology solutions of magnetic materials and their future applications such as advanced electric machines, electric vehicle motors, electromagnetic micromotors and generators, magnetic memory, and MEMS. He earned his PhD in Micro- and Nano- technology from Belarus State University of Informatics and Radioelectronics (Belarus) in 1992. In his thesis work he pioneered application of composite magnetic materials for magnetic heads and hard discs, memory cell. At present he is the author of 5 patents, about 100 publications. He took part in 25 International Conferences, 10 State scientific programs, commercial R&D projects, member of SID and some local scientific societies. He is a technical expert of LG Electronics Company.

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Shailender Gaur

PWD B&R Hisar, India

Technology for future mobility, contribution of nano science; to develop greater strength, motion transformation and ease of outcome

Manmade world is much different than the nature blessed us, since the existence of life on earth. We, the human beings, have triggered the bomb, exploiting the natural resources for our dreams, without thinking what would be cost & effect on price less life. Luckily we have still time to work on this issue and save the environment to a extend. Future technologies can be developed with support of nano science on the bases of thoughts of great of scientist Nikola Tesla, whom we know as father of modern electric technology. He has shown way to develop electric powered automotive solutions and those things are taking shape of reality, now a days. Nano technology can host the platform to see invisible, to do impossible things; developing lighter but stronger materials and energy transformation at much higher speed without losing much of proportions. Nano carbon tubes, insertion of higher micro bonding interface and intermolecular arrangements etc, are holding the key space to deliver & develop worth of technology. Importance of this issue becomes more vital when we talk about my nation, India.

Speaker Biography

Shailender Gaur is currently serving as Sub Divisional Engineer under Mechanical Sub Division at P.W.D. B&R, Branch Hisar, Govt. of Haryana, India. Since last 20 years has been working on various Govt. Projects of mechanical wing and rural water supply, Public Health Engineering Wing. Alongside carried his research interest in renewable power resources, power generation & future technology development for 2030-50, till to date after joining P.W.D. His latest project work under development with Govt. of India is Magnetism & magnetic materials with combination of nano technology & optical materials.

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