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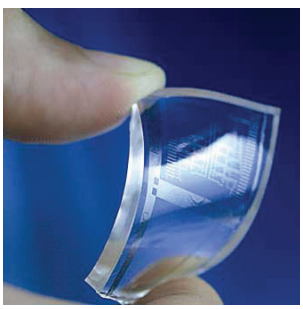
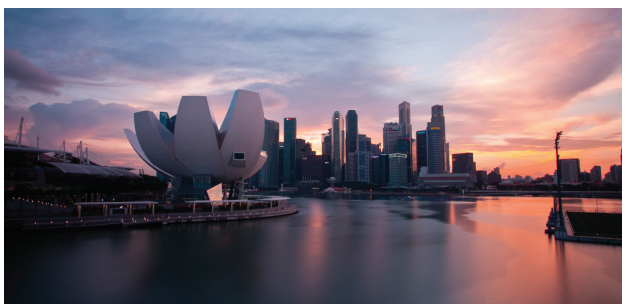
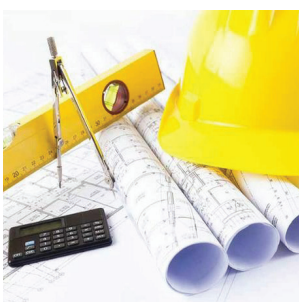
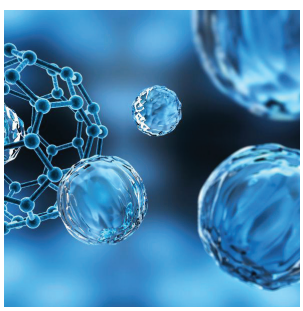
November 21, 2019

Smart Materials & Polymer Chemistry 2019

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Modeling and control of a shock absorber with tunable inertance and damping

An-Ding Zhu[1], Li-Jun Qian[1], Xian-Xu Bai[1], Wei-Min Zhong[1] and **Norman M Wereley[2]**
[1]Hefei University of Technology, China
[2]University of Maryland, USA

Inerter is a two-terminal mass element and the forces applied at its two terminals are proportional to the relative acceleration between the two terminals. The proportional coefficient is called the inertance. The topic of the inerter has received extensive attention because of its unique advantages, such as small weight and no ground restriction of the capacitor in the corresponding circuit system counterpart as compared to the conventional mass element. Inerter has been applied or studied as a passive device in various vibration isolation systems. Aiming at further improving the vibration isolation performance of the systems, the topic of controllable inerter has received much attention. The vibration isolation system with controllable inertance and/or controllable damping has shown obvious advantages compared with the conventional passive inerter-spring-damper system.

Based on the structural design concept of "functional integration", we proposed and designed a shock absorber with both controllable inertance and damping. The proposed shock absorber is composed of a magnetorheological (MR) damper, a MR clutch, a flywheel, a ball screw mechanism, a spring and a housing. The controllable inertance is realized by the coordination between the MR clutch and the flywheel. The ball screw drives the flywheel to rotate together when a certain current is applied to the MR clutch, that is, the inerter works. The ball screw is disengaged from the flywheel when applied no current and the inerter stops working. Thereby, the switching of the working state of the inerter (inertance) is realized by the applied current. In this paper, the shock absorber is modeled, including the controllable inertance of the MR inerter and the controllable damping force of the MR damper. The controllable mechanical properties of the shock absorber are analysed and evaluated. Nonlinear controller for a 1/4 car system using the shock absorber is proposed and verified.

Biography

An-Ding Zhu and Li-Jun Qian, currently working at Hefei University of Technology, China. This presentation is part of a collaboration they continued with Xian-Xu Bai who joined Hefei University of Technology in 2013 and founded Laboratory for Adaptive Structures and Intelligent Systems (LASIS) in 2016. His research interests are focused in two areas. (i) Design, optimization, dynamics, and control of smart structures based on smart materials, including magnetorheological fluids/elastomers and magnetostrictive materials, applied to automotive and aerospace systems, and (ii) New mechatronics-based vehicle dynamics and control in emphasis on intelligent/unmanned vehicles. He has authored over 50 international journal and conference articles. He is an inventor on 16 issued Chinese patents and 2 PCT US patents (pending). Currently, he serves as an Associate Editor of Journal of Intelligent Material Systems and Structures. He is a Committee Member of Adaptive Structures and Materials System Branch of Aerospace Division of ASME. He is a peer reviewer of over 30 international journals. He is a member of ASME, SAE China and IEEE.

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Self-healing epoxy coatings and composites for potential applications

Harikrishnan Pulikkal Parambil
King Mongkut's University of Technology, Thailand

Self-healing materials attract enormous scientific attention as they offer wide range of applications in conjunction with long-lasting performance. Self-healable polymers find potential candidates for construction materials, automotive parts, electrical encapsulation, adhesives, coatings, etc. Due to the light weight, high thermo-mechanical performance, excellent adhesion, gloss, good chemical resistance, and corrosion resistance, epoxy resins are preferred over other polymers for coating applications. Although epoxy resin coatings are widely used in commercial vehicles and high compact aircraft, their susceptibility toward scratches and microcracks is a major concern. Such failures may be addressed by making use of self-healing epoxy coatings.

Biography

Harikrishnan Pulikkal Parambil is currently pursuing Ph.D. degree in Materials Science and Production Engineering from The Sirindhorn International Thai-German graduate institute of Technology, King Mongkut's University of Technology North Bangkok, Thailand. He has published few papers in high quality international journals. His current research interest is the preparation and characterization of smart polymeric materials and Automotive Lightweight Composites.

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Development of polyhydroxyalkanoate-based biomaterials for bone tissue regeneration

Maciej Guzik [1], Katarzyna Haraźna [1], Tomasz Witko [1], Ewelina Cichoń [2], Szymon Skibiński [2], Aneta Zima [2], Anna Ślósarczyk [2], Ipsita Roy [3]

[1]Jerzy Haber Institute of Catalysis and Surface Chemistry Polish Academy of Sciences, Poland
[2]Faculty of Material Science and Ceramics, AGH University of Science and Technology, Poland
[3]Departament of Materials Science & Engineering, Kroto Research Institute, University of Sheffield, United Kingdom

Bio polymers represent one of the leading sectors for bio-based products and their expected growth is foreseen to be significant within the next years. Polyhydroxyalkanoates (PHAs), a class of optically active biodegradable polyesters, are accumulated by numerous bacteria, they are non-toxic and degrade to harmless products. PHAs are excellent bio compatible materials due to the lack of toxicity in contact with human tissue and blood. Development of new composite materials for bone tissue engineering is a constantly growing field of medicine. Therefore there is a continuous need in creating novel materials that can not only regenerate the defected tissue but also nourish it while the healing process progresses.

Here we present a concept of 3D ceramic-polymer scaffolds prepared from one of the representatives of medium chain length polyhydroxyalkanoates, with possibility to use them in regeneration of hard tissue. Two different materials for bone tissue regeneration were prepared: a series of macroporous ceramic composites coated with modified as well as unmodified PHA polymer. We present their morphology along with physicochemical and biological characteristics.

Research funded by The National Centre for Research and Development, grant TechMatStrateg no. TECHMATSTRATEG2/407507/1/NCBR/2019.

Biography

Maciej Guzik graduated from Jagiellonian University in Kraków, Poland with MSc in environmental protection in 2008. Next, he'd undertaken a structured PhD programme at University College Dublin in Ireland. During that time he had been specialised in high cell density fermentation development, downstream and upstream processing of polyhydroxyalkanoates (PHAs), and also genetic manipulation of bacteria. In 2012 he presented thesis entitled "Conversion of postconsumer polyethylene to biodegradable polymer polyhydroxyalkanoate" and successfully graduated from UCD with PhD in industrial microbiology. In the following years he worked in a UCD spin out company Bioplastech, where he was developing fermentation strategies for PHA production. He was also a lead on a project aiming at production of small molecules arising from PHA. In 2015 he moved back to Kraków, his home town, and become a fellow at J. Haber Institute of Catalysis and Surface Chemistry PAS. Here he is a PI of several projects in area of production and application of polyhydroxyalkanoates.

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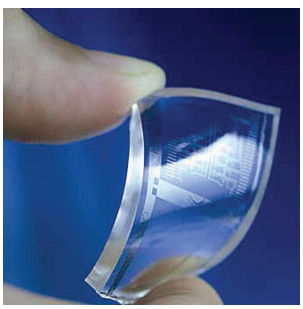
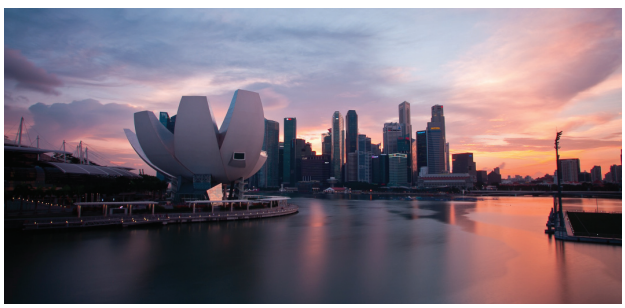

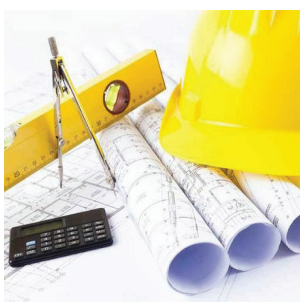
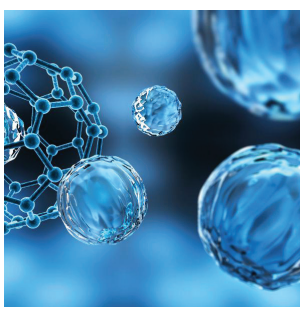

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Smart thermal responsive materials

Y Long
Nanyang Technological University, Singapore

Thermo-responsive material responds to solar spectrum differently at the stimulus of heat which makes it attractive in various applications including the energy saving smart windows application. The most studied inorganic thermochromic vanadium dioxide (VO2) has the intrinsic problems of low luminous transmission (Tlum) and low solar modulation (ΔTsol the transmission difference between high and low temperatures). Numerous efforts such as employing dopings, nanoparticle-based composites, and nano-porous structuring have been widely studied. Our group have developed five new approaches to tackle this veritable challenge, namely, biomimetic nanostructuring including photonic structure and moth eye gridded structures tunable plasmonic structures organic and hybrid structures. In addition, an active control has also been applied to thermochromic material to generate a new electro-thermochromics materials. Some other new emerging thermal responsive materials will be discussed in this talk.

Biography

Y Long studied at Cambridge University, United Kingdom and currently hold senior lecturer position in School of Materials Science in Nanyang Technological University, Singapore. Her research area is to develop different nanostructured functional thin films. She has successfully implemented two technology transfer from lab to industry for Hard Disk Company Seagate Technology. Her more recent work is developing functional smart coatings. She has published widely in high impaction journals such as Joule, Advanced Energy Materials, Advanced Functional Materials, ACS Nano, Journal of Materials Chemistry A and Small, etc. and her work has been widely reported in different media and her work has won TechConnect Innovation Award, Washington in 2015.

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Influence of stir casting parameters on particle distribution in metal matrix composites using stir casting process

M Saravana Kumar
Mount Zion College of Engineering and Technology, India

Particle Reinforced Metal Matrix Composites are generally utilized for various mechanical applications. The main objective of this study is on obtaining uniform particle distribution in metal matrix composites using the stir casting method. The significant part of this work is the experimental investigation of the stir casting technique in a crucible and the effect of stir casting parameter on uniform distribution of particles. The main challenge facing this project is the enhancement of the distribution of particles in molten metal. Silicon Carbide (SiC) and Aluminum alloy (Al-8011) have been proposed as reinforcement and matrix materials respectively. The effect of various parameters such us holding time, blade angle, impeller position and volume concentration for two different viscosity levels (1.24mPa-s and 1.04mPa-s) have been investigated. Composite microstructure has been characterized using Optical Microscope and Scanning Electron Microscope (SEM) in order to find the particle distribution in the composite. The mechanical behavior of the MMC has been assessed based on optimized stir casting parameter for uniform particle distribution.

Biography

M Saravana Kumar has completed his M.E (Master of Engineering) at the age of 24 years from Anna University, Tamil Nadu, India. He is perusing his Ph.D in Anna University, Tamil Nadu, India. He is working as an Assistant professor in Mount Zion College of Engineering and Technology, Tamil Nadu, India.

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