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June 2018 | Volume 7 | ISSN: 2169-0022
Journal of Material Sciences & Engineering

Proceedings of

7th World Congress on

BIOPOLYMERS AND POLYMER CHEMISTRY

June 04-06, 2018 Osaka, Japan

BIOPOLYMERS SUMMIT 2018

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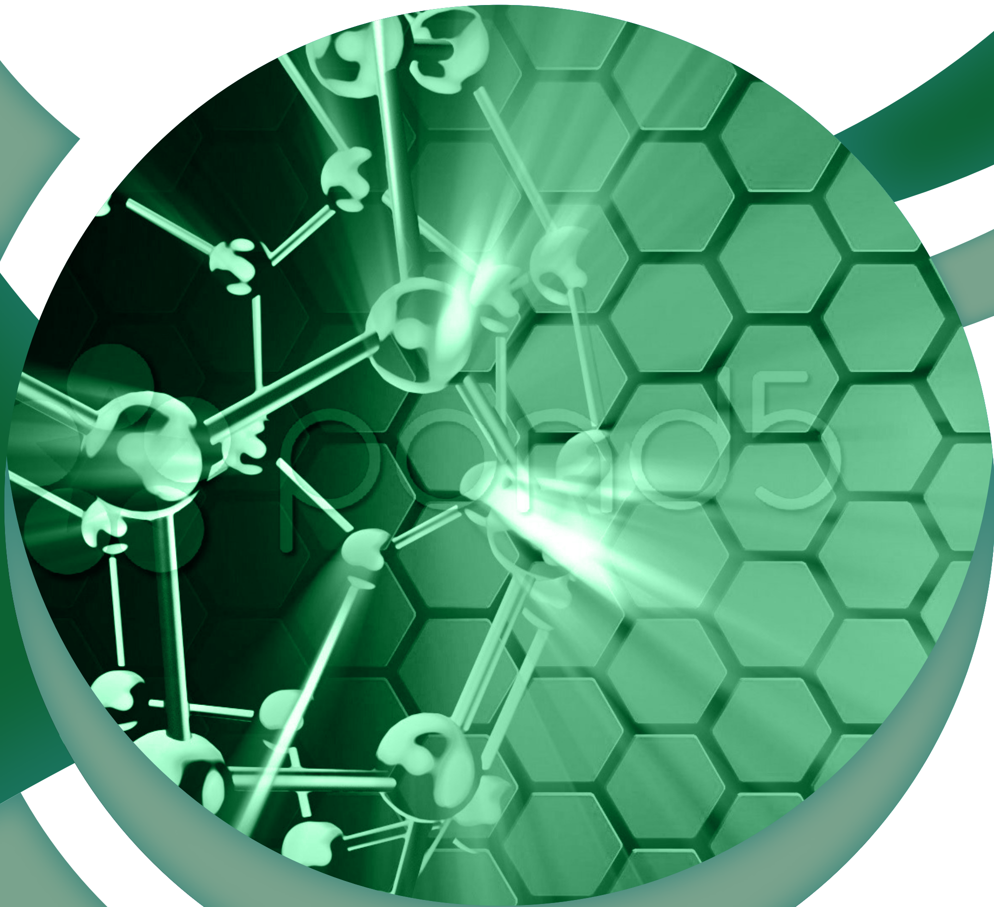

7th World Congress on

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Keynote Forum

(Day 1)

Alexander L Yarin, J Material Sci Eng 2018, Volume 7
DOI: 10.4172/2169-0022-C7-109

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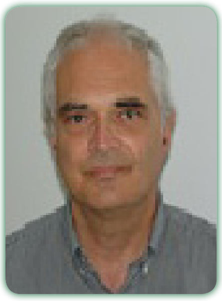

Alexander L Yarin
University of Illinois, USA

Biopolymer derived nanofibers and their applications as biomedical materials and adsorbents for heavy metals removal from polluted water

Solution blowing of such plant derived biomaterials as soy protein, zein, lignin, oats, sodium alginate and cellulose acetate and such animal derived biomaterials as silk protein (sericin), chitosan and bovine serum albumin was demonstrated as a versatile, robust and industrially scalable approach to form monolithic and core-shell nanofibers from bio-waste. Mechanical properties of such nanofiber mats were investigated. The collected nanofiber mats were also bonded both chemically (using aldehydes and ionic cross-linkers) and physically (by means of wet and thermal treatment) to increase the tensile strength to widen the range of applications of such green nonwovens. Fluorescent dye Rhodamine B was used as a model hydrophilic drug in controlled release experiments after it had been encapsulated in solution-blown soy protein-containing hydrophilic nanofibers and the release kinetics associated with dye desorption was studied in detail. Also, the antibacterial activity of solution-blown soy protein nanofiber mats decorated with silver nanoparticles was studied. Nanofiber membranes containing such biopolymers as lignin, oats, soy protein, sodium alginate and chitosan were used for heavy metals adsorption from aqueous solutions in equilibrium in the batch experiments, as well as under the throughflow conditions. The results revealed attractive capabilities of these inexpensive nano-textured biopolymer adsorbents formed from waste materials using the process scalable to the industrial level. The results also elucidated the physicochemical mechanisms of heavy metal adsorption on biopolymers.

Biography

Alexander L Yarin has pursued his MSc in Applied Physics, PhD in Physics and Mathematics and Doctor of Science Habilitation in Physics and Mathematics from The Institute for Problems in Mechanics of the Academy of Sciences of the USSR, Moscow. He has been a Professor at The Technion-Israel Institute of Technology and currently is a Distinguished Professor at The University of Illinois, USA. He is the author of 4 books, 12 book chapters, 310 research papers and 6 patents. He was the Fellow of the Rashi Foundation, The Israel Academy of Sciences and Humanities and was awarded Gutwirth Award, Hershel Rich Prize and Prize for Technological Development for Defense against Terror of the American-Technion Society. He is one of the three Co-Editors of Springer Handbook of "*Experimental Fluid Mechanics*" and the Associate Editor of the journal *Experiments in Fluids*.

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Vimal Katiyar, J Material Sci Eng 2018, Volume 7
DOI: 10.4172/2169-0022-C7-109

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Vimal Katiyar

Indian Institute of Technology Guwahati, India

Effect of functionalized biopolymers on stereocomplexation and properties of poly(lactic acid) nanocomposite films, trays and 3D printed implants

This presentation highlights the use of available bio-resources for value added sustainable polymeric products for engineering, commodity and biomedical applications. Biopolymers can be extracted from renewable feedstock such as plants, marine animals, insects, etc. It is noteworthy to mention that so far biopolymers extracted from these sources have limited applications in large scale plastic production. Among the available bio-based synthetic plastics, Polylactic Acid (PLA) has made its own place due to its biodegradability and potential to replace conventional fossil-based plastics. It is noteworthy to mention that properties such as melting point, heat deflection temperature and gas barrier properties limits its use in high temperature commodity and engineering applications. However, these limitations can be overcome by developing new class of high molecular weight stereocomplex PLA (sc-PLA). In this context, we have synthesized sc-PLA and its sc-PLA-bionanocomposites by using different bio-based nanofillers which include cellulose nanocrystals, silk nanocrystals, modified chitosan, etc. The GPC analysis reveals that the synthesized stereo-complex based bionanocomposites have molecular weight higher than 100 kDa. The formation of stereocomplex crystallites is confirmed by the XRD analysis. Melting point of the composite is increased even higher than 225 °C which suggests the formation of stereocomplex crystallites and the crystallization temperature is enhanced up to ~155 °C at nanofillers loading of 5 wt%. Due to the presence of various bio nanofillers, ultimate tensile strength is enhanced significantly. Based on the studies, it can be concluded that bio nanofillers are good candidates for enhancing the stereocomplexation in the PLA. In this talk, fabrication strategies for synthesis of stereocomplex-PLA-bionanocomposites and evaluation of their properties along with possible applications will be discussed. This talk will also include the processing of these bionanocomposites into caste films and injection molded products for biomedical applications.

Biography

Vimal Katiyar is a Coordinator of Centre of Excellence for Sustainable Polymers in the Department of Chemical Engineering at IIT Guwahati, India. He has published more than seventy peer reviewed publications in highly reputed journals such as *American Chemical Society* and Nature publishing journals. His recently featured book entitled as '*Bio-based Plastics for Food Packaging Applications*' is published by Smithers Rapra, UK. He is a co-inventor of numerous granted patents in various countries including India, USA, Canada, Europe, Japan, etc. His research group has received multiple national and international innovation awards in the development of bio-based polymeric products, nanobiomaterials and related technologies.

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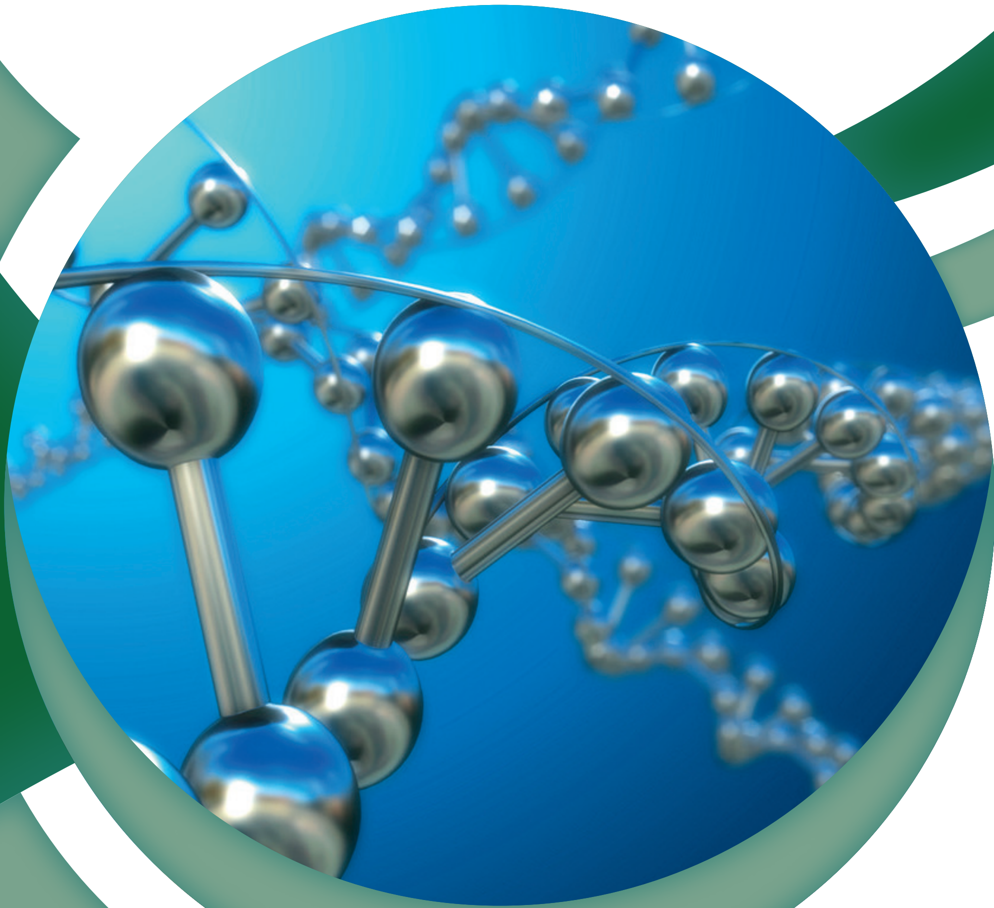

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Keynote Forum

(Day 2)

Tien-Yau Luh, J Material Sci Eng 2018, Volume 7
DOI: 10.4172/2169-0022-C7-109

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Tien-Yau Luh
National Taiwan University, Taiwan

Mimicking DNA chemistry and beyond from ladderphane to stromaphane

A ladderphane is a ladder-like polymer constituted of multiple layers of rigid linkers covalently linked to two or more polymeric backbones. The linkers can be planar aromatic, antiaromatic and macrocyclic metal complexes or three-dimensional organic or organometallic moieties. Structurally, a DNA molecule is a special kind of ladderphane, where the cofacially aligned base-pair pendants are connected complementarily through hydrogen bonding. Two norbornene or cyclobutene moieties fused with N-arylpyrrolidine are employed to connect covalently with rigid linkers. Ring Opening Metathesis Polymerizations (ROMP) of these monomers using the ruthenium or molybdenum catalyst gives the corresponding symmetrical double-stranded ladderphanes. Depending on the catalyst, double bonds in these ladderphanes can be either E or Z selectively. The presence of N-arylpyrrolidene moiety is crucial to control the isotactic stereoselectivity. The linkers in these ladderphanes are aligned coherently along the longitudinal axis of the polymer. Strong interactions between them may take place as evidenced by fluorescence quenching, excimer formation, Soret band splitting or electron hopping. Chiral helical ladderphanes are synthesized by incorporating chiral linkers. These ladderphanes can easily aggregate to form a two-dimensional highly ordered array on graphite surface up to submicron area as revealed by Scanning Transmission Microscopy (STM). Such assembly furnishes an entry to orient planar arene moieties cofacially, while each linear array of such arenes is insulated from the adjacent arrays by the polymeric backbones. Sequential polymerization of a monomer having two different polymerizable groups or replication protocol offers useful entries for un-symmetrical ladderphanes. This route furnishes template synthesis of daughter polymers with well-controlled chain lengths and polydispersity. When cyclopropene having spirally connected N-ary azetidine is used for ROMP, substituted alt-methylene-vinylene with all double bonds in trans-configuration is obtained. The stereo-specificity can be considered as mimicking proofreading and repair in DNA synthesis. Two-dimensional polymers obtained from ROMP of biscyclopropene will be presented.

Biography

Tien-Yau Luh has obtained his PhD degree from the University of Chicago in 1974. After spending two years for Postdoctoral Research at the University of Minnesota, he began his independent research at the Chinese University of Hong Kong in 1976. He moved back in 1988 to his alma mater, National Taiwan University where he has been University Chair Professor. He officially retired from his present post in August of 2016 and was appointed as Distinguished Chair Professor and Professor Emeritus. He has published 290 papers and has received numerous awards. He is also serving as a Member of the Advisory/Editorial Board for the journals like *Chemical Communications, Chemistry-A European Journal, Bulletin of the Chemical Society of Japan, The Chemical Record, Tetrahedron Letters* and Springer *Lecture Notes in Chemistry*. His current research interests include organometallic chemistry in polymer synthesis mimicking bio macromolecules and chemistry of materials.

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Eui-Hyeok Yang, J Material Sci Eng 2018, Volume 7
DOI: 10.4172/2169-0022-C7-109

Eui-Hyeok Yang
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Controlled adhesion of liquid droplets on smart surfaces

The control of adhesion of liquid droplets on solid substrates has broad implications in surface cleaning, water treatment, microfluidics, biochemistry and lab-on-a-chip devices. An earlier report using a conjugated polymer, Polyaniline (PANI) doped with Dodecylbenzene Sulfonic Acid (DBSA), demonstrates the control of the contact angle of a liquid droplet. Poly(3,4-ethylenedioxythiophene) polymers bearing imidazolium ionic-liquid moieties (PEDOT-Im) show multi-responsive properties to a variety of stimuli, such as temperature, pH, oxidative doping and the presence of anions. Recently, there has been a growing number of reports concerning the liquid adhesion and wetting on polypyrrole surfaces. Here it is shown the development and application of smart polymer functional surfaces using dodecylbenzenesulfonate-doped polypyrrole (PPy(DBS)). This presentation demonstrated a novel *in situ* control of droplet pinning on the polymer surface, enabling the control of droplet adhesion from strongly pinned to extremely slippery (and vice versa). The pinning of organic droplets on the surfaces is dramatically controlled *in situ*, presenting a great potential for manipulation and control of liquid droplets for various applications including oil separation, water treatment and anti-bacterial surfaces. It is believed that our work represents a major advance in materials science and engineering, especially pertaining to those topics that involve functional and tunable surfaces.

Biography

Eui-Hyeok Yang is a Professor of Mechanical Engineering Department at Stevens Institute of Technology. He has obtained his PhD from Ajou University, South Korea. After his Postdoctoral Training at University of Tokyo and at California Institute of Technology, he joined NASA's Jet Propulsion Laboratory where he became a Senior Member of the Engineering Staff. At JPL, he had received a number of awards, including NASA ICB Space Act Awards, Bonus (Level B and C) Awards and a number of Class 1 NASA Tech Brief Awards. In recognition of his excellence in advancing the use of MEMS-based actuators for NASA's space applications, he received the prestigious Lew Allen Award for Excellence at JPL in 2003. He is an Associate Editor and/or on the Editorial Board of several journals including Nature's *Scientific Reports.*

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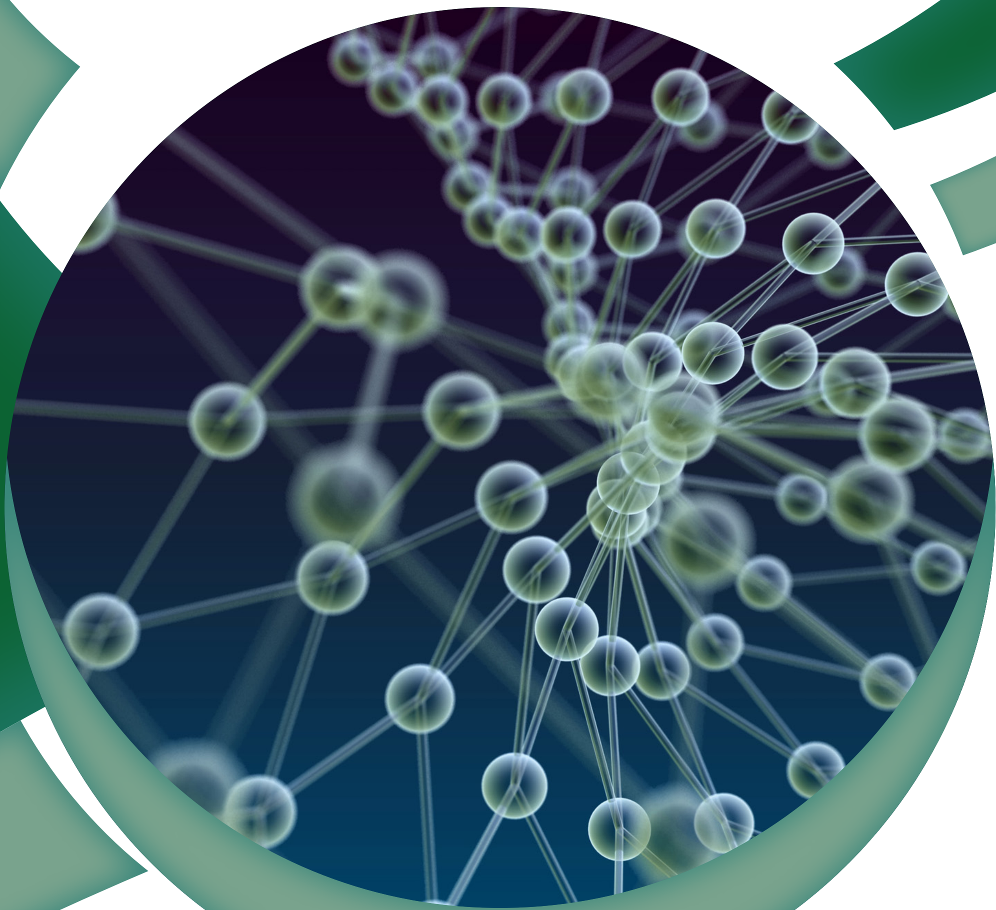

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Keynote Forum

(Day 3)

Xiaoqing Liu, J Material Sci Eng 2018, Volume 7
DOI: 10.4172/2169-0022-C7-109

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Xiaoqing Liu

Ningbo Institute of Material Technology and Engineering, China

Synthesis of bio-based polyesters from 2,5-furandicarboxylic acid: From completely amorphous to high crystallinity

Due to the diminishing crude oil reserve and worsening environmental pollution more and more attention has been paid on the synthesis of polymers derived from renewable resources. However, the thermal and mechanical properties of current bio-based polymers are still subjects to be improved when compared with the petroleum-based engineering plastics like Polyethylene Terephthalate (PET) and Polycarbonate (PC). The lack of aromatic or rigid segments in their molecular architectures should be responsible for the relatively low performance. 2,5-Furandicarboxylic Acid (FDCA) is a promising bio-based platform chemical, which has been referred to as sleeping giants by DuPont and DSM due to its potential as the bio-based substitute for Terephthalate (TPA). The FDCA-based polyester, Polyethylene 2,5-Furandicarboxylate (PEF) demonstrates similar mechanical and thermal properties as well as better barrier properties when compared with its petroleum-based counterpart PET. However, the poor crystallizability of PEF severely limits its application fields, especially when the high transparent and heat-resistant properties or the high crystallinity was required. In our work, several novel cyclic diols, including 1,4-Cyclohexanedimethanol (CHDM) and 2,2,4,4-tetramethyl-1, 3-Cyclobutanediol (CBDO), were employed as the monomer or co-monomer to polymerize with FDCA and the high molecular weight polyesters were synthesized. Results showed that these bio-based polyesters could be varied from completely amorphous to high crystallinity, which has the potential to be used as high transparent packaging materials or polyester engineering plastics, respectively. Based on our results, the bio-based substitute for PET with better comprehensive performance could be developed.

Biography

Xiaoqing Liu is a Professor in Ningbo Institute of Material Technology and Engineering (NIMTE), Chinese Academy of Sciences (CAS). He has obtained his PhD in Polymer Chemistry and Physics from Institute of Chemistry. He had worked as a Post-doctorate in Nanyang Technological University, Singapore and Washington State University, USA. Then he began to work as an Associate Professor in NIMTE and was promoted to a Full Professor. His research work was focused on the synthesis of bio-based polymers and composites, including bio-based high performance epoxy and polybenzoxazine, bio-based polyesters from 2,5-Furandicarboxylic Acid (FDCA). He has published 60+ peer-reviewed SCI papers in the journal of *Green Chemistry, ChemSusChem, Journal of Materials Chemistry A and Polymer* etc. and held more than 30 granted patents in the field of bio-based polymers.

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Jack Y Lu, J Material Sci Eng 2018, Volume 7
DOI: 10.4172/2169-0022-C7-109

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New functional polymers

New functional polymers represent one of the current areas of research interests in materials science. It is well-known that functional materials may have wide range of applications, where they can be used as ion exchangers, molecular sieves and enhancing hydrogen storage capacity, etc. However, energetic polymers have not been well explored in the field. A few newly assembled polymers with energetic functions and potential applications will be discussed along with the novel structural features.

Biography

Jack Y Lu has obtained his Doctorate from Northwestern University in Inorganic Chemistry. His research activities are in the area of design and synthesis of new functional metal-organic polymers.

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