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Editorial
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Editorial

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Research efforts in materials, devices, and structures of interest to human health and well-being continue to grow rapidly. The study of interactions between *in vivo* or *in vitro* biological systems and materials is on the rise.[1] Biomaterials are used in the human body to replace the damaged tissues and improve body functions.[2] Recent advancements in technology and the emergence of new products have increased the performance and applications of biomaterials and biosensors.[3] At this time, metals and ceramics are the major shareholders of the biomaterials market. In the very near future, polymers are expected to dominate the next wave of market growth for biomaterials.[2]

By addressing issues such as biocompatibility, mankind has benefited enormously by the progress of research in biomaterials and biosensors. Currently, the biomaterials market consists of about 100 000 heart valves, 200 000 pacemakers, and 1 million orthopedic devices implanted worldwide each year.[2] The recent wave of new applications has almost doubled the demand for new biomaterials from 8% to 15%. Improved health benefits including increased life expectancy and enhanced quality of life for patients are the most important factors for stimulating the market growth in biomaterials. The increase in aging population, rising awareness and education, shorter product approval time, and larger application area are the reasons for this increased research activity that is now accompanied by enhanced financial investment, infrastructure and support.

Electrospinning of synthetic and biological polymers has been investigated extensively as a unique method for preparing nanofiber scaffolds for tissue engineering. In this issue of Bioinspired, Biomimetic and Nanobiomaterials, the first of the papers[4] by Sherry Wang, Angana Banerjee, Blair Matarlo, Treena Livingston Arinzeh, Zohar Ophir, Michael Jaffe and George Collins from the New Jersey Institute of Technology, is entitled 'Structure and Morphology of Electrospun Collagen Blends'. The authors report in their studies, the use of trifluoroacetic acid as a solvent for collagen and poly(L-lactic acid) to form electrospun fibers with diameters averaging around 350 nm. By performing thermal and structural analyses, the authors confirm the previous observations that collagen-polymer blends are not soluble in physiological fluids.

The second paper,[5] 'Viscoelastic behavior of biodegradable polyhydroxyalkanoates' by Maraolina Domínguez-Díaz and Angel Romo-Uribe of Universidad Nacional Autónoma de México, discusses the thermal properties, microstructure, and rheology of biodegradable poly(3-hydroxybutyrate) (P3HB) and copolymers containing 5% and 12% of 3-hydroxyvalerate. The attractiveness of the study of these materials is based primarily on the characteristics of biocompatibility and biodegradability of the materials. The results show that P3HB is not stable in the molten state thus making melt processing difficult. However, 3-hydroxyvalerate reduces the melting transition but increases the thermal stability, opening up the possibility of melt processing. Rheological studies show that the copolymers display a linear viscoelastic regime, molten 5% 3-hydroxyvalerate exhibits a predominantly elastic behavior, whereas 12% 3-hydroxyvalerate induces a predominantly viscous behavior.

In recent years, several research efforts in the field of biomaterials have focused on forming bioactive ceramic coatings on metallic and non-metallic substrates which are implanted into the human body. The purpose is to tailor the surface through a definite technique for improving the material functions and the effective life time as well as for connecting the substrate mechanical properties to the bioactivity of the bioactive coating. The paper,[6] 'Calcium phosphate coating on Ti6Al4V by autocatalytic route' by Hadeer Ibrahim Mohammed, Wafa Ismail Abdel-Fattah, Mohamed Abdelsattar Sallam, Mahmoud El-Sayed El-Sayed, Mona Salah Eldin, Hassan Talaat, Jacques Faerber, Genevieve Pourroy, Thierry Roland and Adele Carradò is a joint publication from Institut de Physique et Chimie des

Matériaux de Strasbourg, Ain Shams University, Cairo, National Research Centre, Cairo and Institut Charles Sadron, Strasbourg. In this study, the authors present an alternative coating route based on an autocatalytic process on metal alloy, to induce Ca-P layer in a way similar to the process of natural bone formation.

Magnetic iron oxide nanoparticles are attracting increased attention due to their interesting properties that can be used in a large number of applications such as catalysis and biomedicine. The paper,[7] ‘Magnetic iron oxide nanoparticles: synthesis & applications’ by Chengyin Fu and Nuggehalli M. Ravindra from the New Jersey Institute of Technology, focuses on the synthesis, characteristics and biomedical applications of iron oxide nanoparticles. The two most common iron oxides, including magnetite and maghemite, are discussed in this study. The authors also propose a model for the magnetic behavior of iron oxide nanoparticles in a fluid.

Self-assembly involving organic and inorganic elements have been widely used by nature to self-replicate. The layer-by-layer method of producing nano metric thin films has evolved into a widely used enabling technology that can be adapted to form passive and active coatings, devices and architectures leading to its comprehensive list of applications. Praveen Sher and João F. Mano of the University of Minho, Portugal, present their studies[8] on ‘Multilayers as 3D nanostructured porous constructs’. They explore the binding potential of nanostructured multilayers that are produced by layer-by-layer self-assembly based on perfusion technique which has been otherwise limited to coatings only. The authors propose this methodology for use in various applications including adsorption/immobilization, catalysis, drug/gene delivery, sensing, separation, and tissue engineering.

Carbon-based bioMEMS are an emerging class of miniaturized biomedical devices. Due to the numerous advantages such as scalable manufacturing processes, inexpensive and readily available precursor polymer materials, tunable surface properties and biocompatibility, carbon has become a preferred material for a wide variety of future biosensing applications. In the paper,[9] ‘Micro and nano patterning of carbon electrodes for bioMEMS’, Swati Sharma and Marc Madou of the University of California at Irvine review the fabrication methodologies for carbon-MEMS (CMEMS) and carbon-NEMS (CNEMS) devices and strategies for their surface modification for biocompatibility and biosensing. They also discuss the underlying graphitic and glassy microstructures of carbon.

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