ITC Research Student Seminar 2015-16

Date: 23 May 2016 (Monday)
Time: 2:30 pm – 3:30pm
Venue: Room MN109, The Hong Kong Polytechnic University

Speaker: Chen Lina (PhD Student)
Topic: Biomimicking Nano-Micro Binary Polymer Brushes for Smart Cell Orientation and Adhesion Control

Speaker: Jiang Lili (PhD Student)
Topic: Three-dimensional textile structural composites with negative Poisson's ratio

Speaker: Luk Chi Him (PhD Student)
Topic: Removal of synthetic dye and heavy metal via encapsulated microorganisms

Abstracts

Topic: Biomimicking Nano-Micro Binary Polymer Brushes for Smart Cell Orientation and Adhesion Control

We report a new biomimetic surface of extracellular matrix (ECM), namely nano-micro binary polymer brushes, for smart control of cell orientation and adhesion. The biomimetic surface is fabricated by bench-top dip-pen nanodisplacement lithography (DNL) technique over 1 cm2 area, which consists of cm-long nanolines of gelatin-modified poly(glycidyl methacrylate) (gelatin-PGMA) brushes spaced by microstripes of poly(N-isopropylacrylamide) (PNIPAm) brushes. Cells not only adhere well on this biomimetic surface, but also orient along the direction of gelatin-PGMA

nanolines. Upon temperature quenching below the lower critical solution temperature of PNIPAm, the oriented cells can be detached from the surface with well-preserved ECM to form a cell sheet with aligned morphology. Importantly, we also demonstrate that this substrate can be re-used several times without obvious degradation of its smart function. This new biomimetic system shows great potential as a general approach for study of cell biology and biomedical engineering applications.

Topic: Three-dimensional textile structural composites with negative Poisson's ratio

In this study, two types of three-dimensional (3D) auxetic textile structural composites, Composite A and Composite B, were developed for energy absorption. They were both made of 3D auxetic textile structures and treated with silicone based polymer by dip-coating. The reinforcements of two composites were fabricated with 3D auxetic textile structures consisting of warp yarns, weft yarns and stitch yarns. The difference of two composites comes from the arrangement of the warp yarns in their reinforcement structure which leads to quite different deformation and mechanical responses. The quasi-static compressive tests were conducted to study their mechanical properties and deformation mechanism. During compression, the Poisson's ratio in lateral direction were measured and their curves are illustrated. Results show that Composite B exhibits higher initial stiffness due to the close contact of warp yarns between each layer, while the composite A shows higher values of negative Poisson's ratio owing to the easy bending of weft yarns and early contraction of the whole structure. The compressive force versus displacement curves and the compressive force versus energy absorbed curves were also plotted and compared for two composites to investigate their potentials for energy absorption.

Topic: Removal of synthetic dye and heavy metal via encapsulated microorganisms

Since decades, water pollution problems associated with heavy metal and dye contamination have been highly concerned. Conventional methods can no longer achieve desirable purification and adsorption technology has been studied and applied, being one of the very efficient and effective alternative. Biomasses such as plant origins, agricultural wastes, algae, and microorganisms (bacteria, fungi, yeasts) are biosorbents being studied for years. Not just biosorption, but biological means like bioremediations have

also been reported. Nevertheless, adsorptions still have room to improve and the mechanisms involved are important for understandings and applications. Encapsulation is one of the technology which has been applied together with biosorbents to further optimize their applications in industrial plants. In present study, encapsulation of microorganisms with particular polymer to remove synthetic dyes and heavy metal has been studied. Optimizations of the synthesis and physical parameters in the removal process, and the mechanisms were evaluated.

~All are welcome~