The Chinese University of Hong Kong

Department of Biomedical Engineering

Time: 10:30 pm, 16 October 2018 (Tuesday)

Venue: Room 222, Ho Sin-Hang Engineering Building, CUHK

Nanostructured Silicon in Nanomedicine

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Scientific Director of the Melbourne Centre for Nanofabrication

Science Leader at the Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Abstract

This talk will explore the application of nanostructured silicon including porous silicon and silicon nanowires in drug and gene delivery, optical and electrochemical biosensors and in regenerative medicine. These elemental silicon-based materials have high surface area of up to several hundreds of square meters per gram, facilitating loading of considerable amounts of bioactives. Second, pore size can be tailored over a wide range, spanning from the nano- to the microscale. Being able to 'dial in' a certain pore size allows for facile optimisation of topographical cues for attachment, guidance, proliferation and differentiation of target cells. At the same time, the rate of diffusive release of drugs can be tuned by adjusting the pore size. Third, the materials are biocompatible and biodegradable, with the nanostructured elemental silicon undergoing oxidative hydrolysis in aqueous medium at a rate that is easily tunable by means of the surface chemistry from hours to months. A diverse range of surface chemistries is available for this material, some of which are amenable to surface patterning, formation of surface-bound gradients and formation of silicon-polymer hybrid materials. Finally, thin films, membranes and particles of porous silicon display interferometric reflectance and photonic effects, which are responsive to binding of target biomolecules. This talk will first introduce nanostructured silicon material properties and fabrication and characterisation aspects, including describing strategies for nano- and microscale patterning and gradient formation. This will be followed by an overview of the biomaterial applications including examples of the use as a biodegradable biomaterial for ocular tissue and vascular engineering. Drug delivery applications for targeted cancer therapy, immunotherapy and the therapy of ocular diseases will be highlighted. Finally, the use of nanostructured silicon in chronic wound diagnostics and theranostics will be discussed.

Biography

The core research activity in his laboratory is the study of silicon-based nanostructures and their surface chemistry. Following from this more fundamental research, his focus is on the application of silicon-based nanostructured materials in biosensors, biochips, drug delivery and regenerative medicine.

He has authored over 370 peer-reviewed journal articles with over 10,000 citations, h-index 52, and has filed over 25 patents. He has received fellowships from the German Research Foundation (DFG), the CSIRO, the Alexander von Humboldt Foundation, is a recipient of the Tall Poppy Science Award, a finalist for the South Australian Scientist of the Year 2015 and the Australian Innovation Challenge. He is serving on the College of Experts of the Australian Research Council.

***** ALL ARE WELCOME *****

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