

MSE-Colloquium@NTU

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Metal Nanoparticle Foundry: Smart Hydrogels as Platforms for Direct Synthesis and Support

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About the Talk

Redox responsive natural macromolecules, including enzymes and proteins, play a pivotal role in life. Biomedical and other applications of artificial, redox responsive polymeric systems have been limited due to limited access to such synthetic molecules. Poly(ferrocenylsilanes) (PFS), featuring ferrocene units connected by functionalized silane groups in the main chain, constitute a versatile class of smart organometallic polymers with many useful applications ranging from biosensing, smart membranes, adhesion and friction control, programmed molecular release and as “in-situ” redox reactors for controlled production of metal nanoparticles.

In this lecture, a brief overview of PFS synthesis, and structure-property relations will first be provided. Special attention will be paid to hydrogels, and hydrogel shaping by microfluidic devices, layer-by-layer assemblies, and thin film processing. Dual responsive hydrogels consisting of PFS and temperature responsive poly(*N*-isopropyl acrylamide) will then be discussed. Given that PFS has an oxidation potential of around + 0.4 V, it can reduce metal ions to metal nanoparticles when the PFS chains act as a reducing agent. We shall discuss in detail a new metal nanoparticle foundry based on PFS hydrogels, which yield metal nanoparticles with sizes ranging from a few nm to tens of nm-s, without the necessity of using external reducing agents. We demonstrate the universality of the reduction capability of such hydrogels. Potential applications will be sketched, ranging from metal nanoparticle supported catalysis by utilizing fluidic microreactors, to sensing and optoelectronics.

About the Speaker

Prof. Dr. G. Julius Vancso studied physics and materials science at the University of Budapest, Hungary, and at the Swiss Federal Institute of Technology (ETH-Zürich), and holds a PhD in solid state physics. Following a tenured faculty appointment at the University of Toronto, he joined the University of Twente in the Netherlands in 1984 and is at present Professor and Chair holder in Polymer Materials Science and Technology. His current interests involve materials science of smart soft matter for applications in biomaterials as well as in medicine, fluidics and sensing; single molecule studies (AFM, photonics, polymer adhesion and friction), and surface engineering with polymers. He has been appointed to Visiting Professor at Nanyang Technological University in Singapore in 2014. He held Visiting Professorships at the University of California at Santa Barbara, at Budapest Technical University, at the Technical University of Catalonia in Barcelona, and at the ETH in Zurich (Surface Science). Prof. Vancso is Fellow of the Royal Society of Chemistry, and external member of the Hungarian Academy of Sciences. He has published over 480 papers, which earned him over 10,300 citations and an h-factor of 49. He is co-inventor of 6 patents, and co-owner of the spin-off Aerotech B.V., which specializes on polymer composite nanofoams.