

Seminar Series

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5:00 PM – Room 200 Olin Hall

NANOSTRUCTURED INTERFACES FOR ORGANIZED MESOSCOPIC HYBRID MATERIALS

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Abstract

We attempt utilize this advanced knowledge to design organized, integrated, and encapsulated nanostructured materials with complex 2D and 3D topologies via controlled bio-assisted growth of nanostructured materials on templated, functionalized surfaces for prospective sensing applications. Specifically, our research plan is focused on the fundamental mechanism of surface-mediated formation of nanostructured materials facilitated by selective binding of biomolecules (peptides, proteins, and plasma polymerized polypeptides) gently tethered onto solid substrates via polyelectrolyte complexes with multiple weak interactions tunable by external stimuli. We direct bio-assisted binding and growth within pre-designed polyelectrolyte and hydrogel matrices to obtain nanostructured, inorganic or bi-metal nanoparticles, nanodots, and nanorods with desired structure, morphology, and properties.

Several results which will be highlighted in this talk include several topics:

- Monodisperse titania nanoparticles have been grown into silaffin protein nanodomains on/inside multilayered polyelectrolyte matrices as assisted by changes in secondary protein structure
- Monodisperse gold nanoparticles have been grown on uniform and micropatterned poly- amino acid surface layers
- Incorporating gold nanorods into ultrathin LbL hydrogel films resulted in pH-responsive surfaces with dramatic NIR response and 1D nanocob Raman markers
- Bimaterial microcantilever systems based upon plasma polymerization onto silicon beams are extremely sensitive to chemical analytes
- Photomasking of functionalized hydrogels directly on MEMS hair sensors allowed for design of extremely sensitive flow sensors aka blind cave fish



Biography

Vladimir V. Tsukruk received his M.S. degree in Physics in 1978 from the National University of Ukraine, Ph.D and DSc in Chemistry in 1983 and 1988 from the National Academy of Sciences of Ukraine (Yu. Lipatov). He held post-doctoral positions with J. Wendorff (U. Marburg) and D. Reneker (U Akron). Currently, he holds a joint appointment as a Professor at the School of Materials Science and Engineering, School of Polymer, Fiber, and Textile Engineering, and Biotechnology Program, Georgia Institute of Technology. He is a founding co-director of a new GT-Air Force Center of Excellence on Bionics. He has co-authored 270+ refereed articles in archival journals, 20 invited reviews and one book, co-edited three volumes, and holds four patents. He is ranked within top 1% highly cited researchers both in chemistry and materials. His research group of 14 graduate

students and post-docs who conduct research in the fields of nanostructured surfaces/interfaces, molecular assembly, nano- and bioinspired materials are supported by NSF, AFOSR, ARO, DARPA, and private industry.

He is a recipient of the MasCal Pioneering Nanotechnology Gold Award (2007), NSF Special Creativity Award (2006), MIT-IsN Visiting Professorship (2005), NSF RIA Young Investigator Award (1994), Humboldt Fellowship (1990), Best Young Investigator Research Prize in Ukraine (1985), among others. He serves on the editorial advisory boards of Polymer, Res. Lett. Mater. Sci., and Curr. Chem. Biology. He has organized eight international symposia and workshops, served as a Program Chair for Polymer Materials Division, ACS, and graduated 30+ graduate students and post-docs who continue successful carriers in academia, industry, and national labs.