Wolfgang Sigmund, J Material Sci Eng 2017, 6:2 (Suppl)
http://dx.doi.org/10.4172/2169-0022.C1.061

Smart nanomaterials structures

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Surfaces are key for applications that require sticking or non-sticking, high or low friction. We recently investigated surfaces of plants and spiders and transferred these findings into synthetic surfaces. This talk will present three foci: Plastron surfaces that repel all liquids, repulsive van der Waals surfaces for quantum lubrication and tunable surfaces that respond in microseconds to stimuli. By mimicking surface structures of spiders we are able to reduce contact of water and sticking of water droplets to surfaces yielding perfectly spherical droplets without the need for fluorinated compounds. Modifications of these hairy nanostructures are capable of also repelling low surface tension liquids and oils. To further the non-sticking behavior we also investigate quantum mechanical non-sticking surfaces. By tailoring the electronic properties of engineered surfaces we can achieve repulsive van der Waals forces which are the first step towards permanent quantum lubrication. The last part of the talk will discuss how nanofibers in other morphologies can be produced and used to make surfaces that can respond within microseconds to environmental stimuli. Thus a rotating tire can be designed that may respond to the road condition (temperature or moisture) the moment it touches the road and adjust its adhesion according to its design.

Biography

Dr. Sigmund is currently Professor of Department of Materials Science and Engineering at University of Florida, USA. He obtained a B.S. in Chemistry from the University of Heidelberg, Germany. Before obtaining his Ph.D. at the Gutenberg-University of Mainz, he began work on colloidal particle systems at the Max-Planck-Institute for Polymer Research in Mainz with Prof. G. Wegner. In the early 1990's, Dr. Sigmund held post-doctoral positions. He was at RIKEN's (located in Japan) Frontiers of Nanoscience Program in 1992. Then he joined the Max-Planck Institute of Metals research and moved to the University of Florida in 1999. His main focus is on the interdisciplinary development, synthesis, and characterization of novel materials such as nanomaterials for energy harvesting and storage; colloid and surface science; fusion of bioenergy systems with engineered systems; electrospinning of nanomaterials; enhancing materials' properties.

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