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Anisotropic stimuli-responsive polymeric nanoparticles and copolymers with self-healing properties

This lecture will focus on the design, synthesis and characterization of stimuli-responsive anisotropic nanoparticles with various morphologies. Size- and shape-tunable Janus as well as gibbous and inverse-gibbous nanoparticles will be discussed in the context of heterogeneous radical polymerization (HRP) developed to synthesize ultra-high molecular weight amphiphilic block copolymers. The second part will describe unique self-healing properties of acrylic-based copolymers which occurs in a narrow compositional range for preferentially alternating with a random component copolymer topology (alternating/random). This behavior is attributed to favorable interchain van der Waals forces forming “key-and-lock” interchain junctions. The use of van der Waals forces instead of supramolecular or covalent rebonding, or encapsulated reactants eliminates chemical and physical alterations and enables multiple recovery upon mechanical damage without external intervention. As a result of perturbation of van der Waals forces resulting from mechanical damage the presence of interdigitated alternating/random copolymer sequences facilitate self-healing under ambient conditions.

Speaker Biography

Marek W Urban is the J.E. Sirmine Foundation Endowed Chair and Professor of Materials Science and Engineering and Chemistry (courtesy) Departments at Clemson University. He received MS in Chemistry from Marquette University, PhD in Chemistry and Chemical Eng. Department from Michigan Technological University, and postdoctoral at Case Western Reserve University. Prior to joining Clemson University, he was a professor, Department Chair and director of polymer science programs at NDSU and USM, where he also directed the Materials Research Science and Engineering (MRSEC) as well as Industry/University Cooperative Research (I/U CRC) Centers funded by the National Science Foundation. He is the author of over 400 research publications and 11 patents, author of four and editor of seven books. His research on self-healing polymers and antimicrobial polymer surfaces has been featured by many media, including NY Times, Forbes, BBC, NBC, Discovery, USA Today, Yahoo, ACS, NSF and many others. He is the Fellow of American Chemical Society PMSE Division, the Royal Society of Chemistry, American Institute of Chemists, and recipient of numerous awards, most recently the Chemical Pioneer Award from Chemical Heritage Foundation (2017) and University Research, Scholarship and Artistic Achievement Award (2018). His research group current research efforts focus on the development of polymeric materials and interfaces with ‘living-like’ functions. Of recent interests are self-healing commodity polymers, new generations of stimuli-responsive materials with adaptable, sensing, and signaling functions, including colloidal nanoparticles and other nano-objects, as well as spectroscopic imaging methods enabling molecular detection of stimuli-responsiveness.

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