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Nano-engineered polymer coatings and capsules for controlled delivery

Needs in controlled delivery and biomedical engineering urge a design and development of 'smart' stimuli-responsive materials. This talk will focus on nanostructured polymeric coatings and capsules obtained by layer-by-layer (LbL) assembly of water-soluble polymers at solid-liquid interfaces. Two related classes of LbL systems, where interactions between adjacent layers are controlled by electrostatic or by hydrogen-bonding forces, will be presented with focus on their assembly and environmentally-triggered response. First, we will discuss the unique capability of thin polymer coatings to reversibly load and release functional molecules in response to environmental changes such as pH, temperature, light, and electric field. Then, we will introduce routes for designing stimuli-responsive polymeric microcarriers (capsules) with well-controlled properties of the nanostructured capsule wall. The capability of tuning capsule response to the desired range will be discussed with the focus on their controlled permeability and delivery cargo on demand. Finally, we will address an application of LbL films in cell-based transplantation therapy for diabetic recipients. LbL films of natural polyphenols and synthetic polymers are deposited on surfaces of pancreatic islets. The strategy provides cytocompatible biologically active coatings with diminished inflammatory immune responses and allow for greater enhanced viability, prolonged function, and development of noninvasive imaging. The coatings are crucial for long-term studies of in vitro/in vivo islet function and open new avenues in the area of advanced islet transplant materials.

Biography

Eugenia Kharlampieva is an Assistant Professor at the Department of Chemistry with the second appointment at the Center of Nanoscale Materials & Biointegration, University of Alabama at Birmingham (UAB). She received her Ph.D. in Polymer Chemistry from the Stevens Institute of Technology followed by her Postdoctoral training in Polymer and Materials Science at the Georgia Institute of Technology. Her research is focused on synthesis of polymeric bio-mimetic materials as novel platforms for therapeutic applications. She has published more than 45 papers serving as an Executive Committee member of SHUG (SNS and HFIR User Group) at Oak Ridge National Lab.