UC San Diego
JACOBS SCHOOL OF ENGINEERING
NanoEngineering

UCSD NANOENGINEERING/CHEMICAL ENGINEERING

Virtual SEMINAR SERIES

Wednesday, October 7, 2020
Seminar Presentation: 11:00am – 12:00pm PT
Zoom Seminar

"From Natural to Synthetic Polymers: Understanding of Structure-Process-Property Relationships"

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Abstract: The creation of hybrid material systems that integrate the properties of synthetic polymers with natural polymers has opened the door to the development of functional materials in a simple and sustainable manner. Silk is one of the oldest natural biopolymers, used in the textile and biomedical worlds, yet more recently recognizing as an attractive material for emerging fields, such as flexible and wearable electronics, energy conversion and storage devices, environmentally adaptive materials, filtration, photonics, and sensing systems. These newer utilities derive from: (1) the ability of silk to be formed into unique nanoarchitectures through hierarchical self-assembly for processing into various material formats, such as films, nanofibers, hydrogels, and sponges, with high fidelity feature resolution down to the nanoscale, and (2) the availability of silk as an abundant natural resource with eco-friendly properties that can help meet the growing demand for sustainable materials.

This talk will highlight our understanding of structure-process-property relationships of natural and synthetic polymeric material systems, respectively. The first part of this talk will present how dityrosine crosslinking can be used to design silk protein-based hydrogels for biomedical applications. The second part will be moved on to the synthetic block copolymers and discuss how we can control the lateral ordering of block copolymer nanostructures using minimal topographic patterning and characterize these nanostructures using grazing incidence small angle X-ray scattering (GISAXS). This presentation will provide an overview that an improved understanding of the structure-process-property relationships can provide novel insights into designing and implementing hybrid materials with unique properties and multiple functions.

Educational Development and Training: This talk will provide basic concepts of natural and synthetic polymers, crosslinking, top-down lithographic techniques, and bottom-up self-assembly processes. Overall, these studies can serve to advance our fundamental understanding of structure-process-property relationships of polymeric material systems and help us in designing and manufacturing functional hybrid materials, which are not accessible by singular natural or synthetic component scaffolds.

Biosketch: Jaewon Choi is a postdoctoral scholar in the Department of Biomedical Engineering at Tufts University working with Prof. David Kaplan, where his research focuses on understanding of structure-property relationships of silk protein-based biomaterials for biomedical applications. He earned his Ph.D. in Polymer Science and Engineering at the University of Massachusetts Amherst in 2017, where he was the recipient of Samsung Scholarship. He worked under the guidance of Prof. Thomas Russell and Prof. Kenneth Carter, which focused on guiding the self-assembly of block copolymers in 2D and 3D with minimal patterning for applications in nanoscale lithographic templates and 3D nanofabrication. He completed his B.S. in Chemical Engineering with summa cum laude at Inha University.