CHEMISTRY & BIOCHEMISTRY COLLOQUIUM: Protein-Based Bioplastics for Sustainable Additive Manufacturing

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Professor of Chemistry
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Date:
10/28/2022

Time:
10:30 PM-11:50 AM

Location:
Please email snsgradstaff@ucmerced.edu for Zoom link.

About The Speaker:

Alshakim Nelson is a Professor of Chemistry and the Director of Education at the Molecular Engineering and Sciences Institute at the University of Washington. He received his PhD in chemistry from the University of California, Los Angeles in 2004, where he worked with Sir J. Fraser Stoddart on carbohydrate-containing polymers and macrocycles. He was then an NIH postdoctoral fellow at the California Institute of Technology working for Professor Robert Grubbs on olefin metathesis catalysts for the formation of supramolecular ensembles. Dr. Nelson was a Research Staff Member at IBM Almaden Research Center for 10 years where he focused on the synthesis of nanomaterial building blocks that enabled large area nanomanufacturing via self-assembly. In 2015, Dr. Nelson joined the faculty at the UW, where his research group focuses on the synthesis, characterization, and processing of stimuli-responsive materials for 3D printing. Dr. Nelson has over 70 publications and 25 issued pa tents. His honors and awards include recognition as an IBM Master Inventor, Kavli Foundation Fellow, and NSF CAREER award.

Abstract:

Bio-sourced and biodegradable polymers for additive manufacturing could enable the rapid fabrication of parts for a broad spectrum of applications ranging from healthcare to aerospace. However, a limited number of these materials are suitable for vat photopolymerization processes. Herein, we report a process to fabricate protein-based constructs using commercially available vat photopolymerization printers. Bovine serum albumin (BSA) is a single-chain nanoparticle that can be chemically derivatized with acrylate and methacrylate functionalities. Aqueous resins were formulated from these materials to produce complex 3D geometrical constructs with a resolution comparable to commercial resins. While BSA is often used in cell culture protocols and diagnostic assays, we demonstrate that BSA can serve as junctions within polymer networks to afford stiff hydrogels and bioplastics with unique physical properties. Protein-based shape-memory objects and engineered living mat erials were 3D printed and will be highlighted as opportunities for future applications.

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