

### CNDE Webinar Presentation April 11, 2024 - 10:00 a.m. CST

This webinar will be recorded and made available on the CNDE website



### Nature Inspired Materials Processing and Manufacturing

Presented by: Nicole Hashemi  
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#### Abstract:

Composite materials are desired for several reasons, including reduced weight, increased strength, and reduced production cost. Each application typically necessitates a unique and precisely defined set of material properties in composites, tailored to its specific functional and performance requirements. We have used a hydrodynamic spinning strategy to manufacture composite fiber materials with desired properties. This approach represents a paradigm shift from current methods of manufacturing composite fibers, offering a bioinspired, versatile process with precise material formulations and processing parameters. We have demonstrated the ability to tailor the shape and size of biocompatible fibers on demand using hydrodynamic spinning.

In our hydrodynamic spinning approach, composite fibers are formed using a coaxial flow of pre-polymer and crosslinking agents in a microchannel. Fibers can be produced on multiple length scales with a wide variety of shapes using various polymer chemistries and material compositions. The fiber length scale can be adjusted from tens to several hundreds of micrometers by controlling the ratio of core and sheath flow rates, solutions viscosities, and channel dimensions. The ability to produce uniform, monodisperse microfibers with tailored morphological, structural, thermal, and chemical features opens up possibilities for emerging defense technologies.

#### Speaker:

Dr. Nicole Hashemi is an Associate Professor in the Department of Mechanical Engineering at Iowa State University. Her research interests are in the areas of microfluidics and materials processing. She is the recipient of the 2023 NSF Mid-CAREER Advancement Award. She has also been the recipient of the NSF EAPSI Fellowship, NRC Postdoctoral Fellowship, NRL Research Publication Award, Big 12 Faculty Fellowship Award, and ISU Early Career Engineering Faculty Research Award. Hashemi has been selected as both the National Academy of Engineering US Frontiers of Engineering and the National Academy of Sciences Kavli Frontiers of Science. She is a Fellow of the American Society of Mechanical Engineers and a Fellow of the Royal Society of Chemistry. She is an Associate Editor of ASME Journal of Biomechanical Engineering.

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