Nebraska Center for Materials and Nanoscience

2017 Fall Seminar Series

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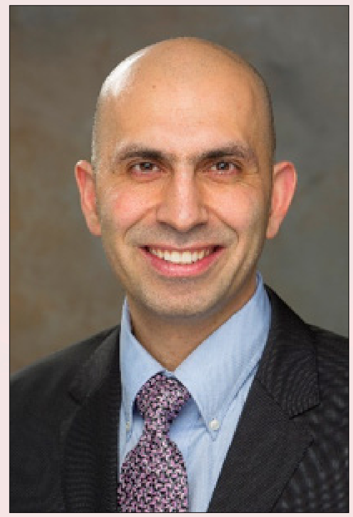
Initiated and Oxidative Chemical Vapor Deposition for Polymeric Materials Synthesis and Integration

Initiated and oxidative chemical vapor deposition (iCVD/oCVD) are novel surface polymerization techniques. Polymer CVD enables the synthesis of stoichiometric polymers that can be applied to a variety of materials and structures. In iCVD and oCVD, the surface adsorption of reactive species is typically the rate-limiting step. As a result, the polymer growth and properties can be tuned by adjusting the surface availability of the reactants.

In this work, iCVD and oCVD were utilized for the synthesis and integration of polymer materials in the nanostructured electrodes of energy conversion and storage devices. iCVD was used to synthesize and integrate polymer electrolyte while oCVD was utilized to deposit polythiophene (PTh) as a potential conducting polymer. Polymer electrolyte was integrated within the mesoporous electrode of a photoelectrochemical cell allowing for near complete pore-filling. The resulting devices fabricated with iCVD polymer electrolyte showed superior performance compared to their liquid counterparts. Similarly, PTh was integrated in the porous electrode of activated carbon supercapacitors.

The resulting devices with oCVD PTh were found to have significantly higher charge storage capacity as a result of nanoscale confinement of the polymeric domain. Overall, the viability of iCVD and oCVD techniques for the design, synthesis, and processing of polymers in nanostructured architectures for energy applications will be demonstrated.



Dr. Siamak Nejati joined the Department of Chemical and Biomolecular Engineering of the University of Nebraska at Lincoln in 2016. He completed his B.S. in Chemical Engineering at Sharif University of Technology in 2004. He received his Ph.D. from Drexel University. In 2013, he moved to Yale University as a postdoctoral research associate, working under the supervision of professors Menachem Elimelech and Chinedum Osuji. At Yale, Dr. Nejati's research focused on materials development for membrane-based separation processes. During his doctoral studies, he developed new methods to integrate polymeric materials into highly tortuous matrices. Dr. Nejati's research interest centers on polymeric materials, nanostructured devices and coatings. He strives to develop economically viable and advanced methods for addressing the current challenges to water and energy supplies and security.

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136 Jorgensen Hall