Chemistry / Polymer Seminar

2021 Fall Webinar Series

Thursday, Nov 4, 3:30 pm

In-Person : Chemistry Building room A-203

Webex Link: https://uconn-cmr.webex.com/meet/mak20019

"Polymer Grafted Nanoparticles as Novel Gas Separation Membranes and PBI Polymers for Fuel Cells"

Prof. Brian Benicewicz

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Abstract:

Over the past 15 years, the application of controlled radical polymerization techniques has enhanced our ability to design the critical interface between inorganic particles and polymer matrices. In particular, we have used the RAFT polymerization method with polymer grafting techniques as an approach to prepare polymer brush surfaces on nanoparticles with a variety of functional polymers. Interestingly, this diversity of design strategies is not limited to a single population of chains. Another set of RAFT agents can be attached to the remaining free surface and a second (or third) population of polymer chains can be polymerized from the surface of the same particles, with a completely independent set of molecular variables (chain density, molecular weight, chemistry, architecture, etc.) from the initial population of grafted chains. Thus, an almost limitless design space is available to create highly specified polymer brush compositions on nanoparticles. These polymer brush nanoparticles can form films that have an order of magnitude increase in gas permeability relative to the pure polymer. This presentation will provide an overview of the chemistry used to prepare multimodal polymer-grafted nanoparticles and recent results of using polymer brush nanoparticles as gas separation membranes.

We have also been investigating polybenzimidazole (PBI) polymers for high temperature PEM fuel cells operating at 100-200˚C. Using the sol-gel PPA process, we have explored the effects of chemical structure on membrane properties, including issues related to membrane formation, stability and durability. Membranes produced from this process showed the ability to maintain high levels of phosphoric acid (PA) and high proton conductivities while simultaneously exhibiting low levels of PA loss during operation in many simulated duty cycles. Most recently, we have started to evaluate PBI membranes for current and future air transportation applications.

For more information, please contact Osker Dahabsu at osker@uconn.edu