SOLVAY

Solvay Seminars in Macromolecular Science & Engineering

Macromolecules Innovation Institute (MII)

VIRGINIA TECH

Prof. Sanat Kumar

"Polymer-Grafted Nanoparticle Membranes with Controllable Free-Volume"

Columbia University
Bykhovsky Professor
Department of Chemical Engineering

Host: Greg Liu

Abstract: Polymer based membranes play a key role in several industrially important gas separation technologies, e.g., removing CO_2 from natural gas, with enormous economic and environmental impact. Baker advocates the development of novel membrane architectures since current, pure polymer membranes only offer limited systematic pathways for improvement. Here, we develop a novel hybrid membrane construct comprised entirely of nanoparticles grafted with polymers. These membranes are shown to have broadly tunable separation performance through variations in graft density and chain length. Computer simulations show that the optimal NP packing forces the grafted polymer layer to distort, yielding regions of measurably lower polymer density. Multiple experimental probes confirm that these materials have the predicted increase in "polymer free volume", which explains their improved separation performance. These polymer-grafted NP materials thus represent a new template for rationally designing membranes with desirable separation abilities, coupled with improved aging characteristics in the glassy state and enhanced mechanical behavior.

Columbia University
Department of Chemical Engineering
New York, NY 10027
Phone: 212-854-2193
E-mail: sk2794@columbia.edu

Bio: Sanat Kumar earned his Sc.D. from the Massachusetts Institute of Technology in 1987. Previously, he earned his S.M. from MIT in 1984 and B.S. in Chemical Engineering from the Indian Institute of Technology in 1981. He has been on the faculty at Columbia University since 2006 and was named the Bykhovsky Professor of Chemical Engineering in 2016. His research interests include synthetic- and bio-polymers, nanocomposites, and nanomaterials.

Sponsored by the
Solvay International Chemical Group

DATE: SEPTEMBER 5, 2018
TIME: 11:15AM-12:15PM
LOCATION: KELLY HALL 310