CHEMICAL ENGINEERING
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CHEMICAL ENGINEERING 290 SEMINAR SERIES PRESENTS

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2-dimensional zeolites for catalysis and separations

It is only recently that single-unit-cell thick zeolite nanosheets (2-dimensional zeolites; AIChE Journal 60(7), 2374-2381 (2014)) with intact crystal and micropore structure were shown to be possible. The structural integrity and unprecedented purity and uniformity of these microporous nanosheets, open exciting possibilities for technological breakthroughs in molecular sieve membrane fabrication, synthesis of hierarchical catalysts and polymer-zeolite nanocomposites. Moreover, zeolite nanosheets enable for the first time zeolite pore mouth adsorption and catalysis to be studied by traditional uptake methods as well as surface science techniques. However, along with the exciting possibilities, challenges abound. For example, the in-plane dimensions of the existing nanosheets are in the sub-micrometer range limiting potential applications and processability as thin films. Moreover, the two exfoliated zeolites currently available are only a small fraction of zeolite topologies one would like to have available for a representative set. Earlier attempts to exfoliate other layered zeolites, including certain layered silicates and aluminophosphates with microporous layers, did not preserve the crystallographic order of the layers. Synthesis of high aspect ratio zeolite and other crystalline nanoporous nanosheets, methods to characterize their structure and properties, along with their processing and assembly to create membranes and catalysts will be the focus of this talk.

Michael Tsapatsis joined the Department of Chemical Engineering and Materials Science at the University of Minnesota in September 2003 as a professor and he currently holds the Amundson Chair. He received an Engineering Diploma (1988) from The University of Patras, Greece, and MS (1991) and Ph.D. (1994) degrees from the California Institute of Technology (Caltech) working with G.R. Gavalas. He was a post-doctoral fellow with M.E. Davis at Caltech (1993/94). Before joining the University of Minnesota he was a faculty member in the Chemical Engineering Department at the University of Massachusetts Amherst (1994-2003).

His research group accomplishments include the development of molecular sieve catalysts and membranes, adsorbents that are now used in a commercial process, and oxide nanoparticles that have been recently commercialized.

He has supervised/co-supervised to completion the PhD thesis of ~30 graduate students and advised ~20 former postdoctoral fellows who now pursue influential careers in the chemical and microelectronics industries, in national labs and in academia. His current teaching interests are in transport phenomena and process/product design with emphasis on energy efficient separations and process intensification. He is a fellow of AAAS and member of the National Academy of Engineering.

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