Stevens Institute of Technology

Nanotechnology Graduate Program

Novel micro- and nanospectroscopies: study of catalysis in zeolite nanopores

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Spectroscopic methods are essential for a fundamental understanding of processes in complex chemical systems. Although most techniques provide average information about examined samples, in many cases, it is essential to probe the local structure in order to establish structure-property relationships. Novel spectroscopic methods featuring micro- and nanometer spatial resolutions open exciting opportunities in this field. The application of these new methods will be showcased with an example of a nanoporous zeolite catalyst, which was studied with fluorescence microscopy, electron backscattering diffraction (EBSD), and synchrotron micro-focus X-ray fluorescence spectroscopy. The catalytic activity was evaluated with a probe reaction of styrene oligomerization using a combination of Raman, UV-Vis, confocal fluorescence and synchrotron infrared spectroscopies. This “no stone unturned” combined microspectroscopic approach makes it possible to correlate the material structure with catalytic activity at the molecular level.

In the second half of the seminar, an overview of the synchrotron facilities available to general users at Brookhaven will be given. Spectroscopic characterization of nano-scale systems with particular emphasis on multi-technique studies, including spectroscopy, X-ray scattering and electron microscopy, will be reviewed.

Dr. Eli Stavitski focuses on development of dynamic spectroscopic methods, including synchrotron-based techniques for catalysis, microfluidics and life science applications at the National Synchrotron Light Source at the Brookhaven National Laboratory. Dr. Stavitski received his Ph.D. in Physical Chemistry from the Hebrew University in Jerusalem, Israel, in 2005 and then completed postdoctoral training, which included a personal Dutch Science Foundation VENI grant, at Utrecht University and Technical University of Delft in the Netherlands..

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