UNIVERSITY OF DELAWARE

CHEMICAL & BIOMOLECULAR ENGINEERING

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NEW TOOLS FOR CATALYSIS AT NIST-OPERATED X-RAY BEAMLINES

A growing number of catalyst characterization tools have been developed at the hard and soft X-ray beamlines NIST operates at the National Synchrotron Light Source II. I will provide a brief overview of these capabilities in the context of recent dehydrogenation and CO2 valorization studies. At the soft X-ray beamline, a NIST-built transition-edge sensor array enabled partial fluorescence yield near-edge X-ray absorption fine structure (NEXAFS) measurements. This technique has a long history of application to carbon- and oxygen-based adsorbates and is also particularly useful for studies of dilute metals in insulating materials, a recurring problem in catalysis. In addition, I will give a brief overview of a recently launched project to develop and install first-of-kind instrumentation for high-throughput, operando resonant inelastic X-ray scattering (RIXS) experiments on industrial catalysts at the soft X-ray beamline. At the hard X-ray beamline, we have developed in situ XAFS capabilities for complementary studies on heterogeneous catalysts. These tools are ideal for tracking the metals in a catalyst throughout its activation and use. As an example, I will highlight recent measurements of transition metal-exchanged zeolites which monitored the coordination structure and electronic structure of the metal during reaction. This will include a description of the integrated gas pulsing/ handling and mass spectrometry facilities at the beamline.

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