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Operando characterization of nanocatalysts via spectroscopy, scattering and imaging techniques in the same micro-reactor YUANYUAN LI, ANATOLY FRENKEL, Physics Department, Yeshiva University, PHILIPP BAUMANN, University of Applied Sciences of Northwestern Switzerland, RYAN TAPPERO, NSLS, Brookhaven National Laboratory, DMITRI ZAKHAROV, ERIC STACH, CFN, Brookhaven National Laboratory, ANNIKA ELSEN, ULRICH JUNG, RALPH NUZZO, Department of Chemistry, UIUC — The increasing demand to rationally design new catalysts for energy generation/conversion calls for improvements in research methodology which enables multi-technique investigations of working catalysts in reaction conditions. Using the operando approach is necessary to establish structure activity/selectivity relationship. However, this approach is hindered by many challenges, e.g., the incompatibility of different characterization methods with respect to the sample concentration and environment, and, hence, the need to use multiple in situ reactor designs. We report on the development and tests of the single, portable reactor compatible with most useful techniques for operando studies of nanocatalysts: X-ray absorption, transmission electron microscopy, infrared and Raman spectroscopies. The test system was Pt/SiO2 nanocatalyst and the reaction was the ethylene hydrogenation. The reactor was a closed cell with SiN windows enabled catalytic reactions under atmospheric pressure. Both XAFS and TEM experiments were conducted in identical conditions, while monitoring the product formation using mass spectrometry. Comparison of TEM and XAFS results provided new information on the structure-activity relationship of these catalysts.

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