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One Step Propylene Epoxidation by Size Selected Subnanometer Cluster Silver Catalysts: Structure-Function Relationships Resolved Through in Situ Studies ERIC TYO, BING YANG, Materials Science Division, Argonne National Laboratory, JANAE DEBARTOLO, SONKE SEIFERT, X-ray Science Division, Argonne National Laboratory, STEFAN VAJDA, Materials Science Division and Center for Nanoscale Materials, Argonne National Laboratory — The selective partial oxidation of propylene at low temperatures is accomplished by soft-landed, size selected subnanometer Ag clusters. The activity and selectivity for the creation of propylene oxide vs. acrolein is found to be size and support dependent, determined through the temperature programmed reactivity (TPRx) investigation of three cluster sizes between 3 and 20 atoms and three supports (Al2O3, TiO2, and ZnO). in Situ synchrotron X-ray characterization including Grazing Incidence Small Angle X-ray Scattering (GISAXS) and Grazing Incidence X-ray Absorption Spectroscopy (GIXAS) were performed to determine structural morphology and oxidation state during catalytic activity. The oxidation state of the Agn clusters (GIXAS) varies significantly due to size and support. At higher temperatures, changes in size due to assembly are observed through GISAXS with marked dependence on support with aggregates presenting distinct chemical properties and activity. Utilizing the presented method of catalyst synthesis and in situ characterization, it is feasible to investigate single active sites without the convolution that occurs in many studies from a range of particles sizes and active sites being present.

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