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***In situ* GISAXS Study of the Reactivity of Supported Metal Nanoclusters.** Randall E. Winans[1], Stefan Vajda[1], Byeongdu Lee[2], Soenke Seifert[2], George Y. Tikhonov[1], Nancy A. Tomczyk[1], [1]Chemistry, and [2]Experimental Facility Divisions, Argonne National Laboratory, 9700 S. Cass Ave., Argonne, IL 60439.

Sintering of supported catalytically active nanoparticles during chemical reactions at elevated temperatures often leads to the loss of the catalytic activity and selectivity of these particles. The thermal stability of deposited platinum and gold nanoparticles have been studied using grazing incidence small angle X-ray scattering (GISAXS). The clusters were prepared by laser vaporization, mass selected and deposited on silicon (111) or an atomic deposition modified silicon surfaces. Both regular and anomalous GISAXS data were collected (APS 12ID) as the samples were heated in vacuo or with exposure to reactive gases. An unexpectedly high thermal stability of Pt nanoparticles preserving their original size up to about 320 °C was observed. Cylindrical particles were observed at lower levels of coverage and more spherical forms at higher levels. The kinetics data indicate a two-step agglomeration process. These experiments demonstrate the powerful combination of cluster deposition, atomic layer deposition and synchrotron techniques, which can aid in characterization and design of new nanoparticle-support combinations with potential use in catalysis.

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