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Dynamics on nanointerfaces investigated by ultrafast electron nano-crystallography CHONG-YU RUAN, YOSHIE MUROOKA, RAMANI KALYAN RAMAN, RYAN MURDICK, Michigan State University — The correlation between the material structures and the size-dependent properties is a fundamental problem in nanoscience. Through the development of ultrafast electron nano-crystallography and spectroscopy techniques, we have looked at some important mechanisms pertaining to the nanometer scales. To accentuate the structurally correlated transformations from bulk to the molecular length scale, we size-select and deposit nanoparticles (Au, Ag) on well characterized interfaces. Using femtosecond optical pulse as the pump and femtosecond electron pulse as the probe, the electronic and temperature driven transformations of nanostructures and phases are examined at calibrated levels on the energy landscape with atomistic spatial-temporal resolutions ($\leq 10^{-12}$ sec, ≤ 0.01 Å). We observed the ultrafast nonthermal phase transformations of nanoparticles with transient full-scale radial distribution function accurately determined. The coherent motions of atoms driven by nonthermal energy transfer persist into the liquid phase. But the recrystallization process is more thermal-like with interesting reconstruction of lattices from the melt, nonreciprocal to that of melting. We also examined the ultrafast molecular structural responses to charge transfer that exhibits a dynamical phase transition going from conducting to insulating phases.

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