Abstract Submitted
for the 4CF13 Meeting of
The American Physical Society

Structure and Morphology of Gold Nanoparticles Revealed with the Aid of Coherent X-Ray Diffraction JAMES HANSON, New Mexico State University, KATE PAGE, Los Alamos National Laboratory, S. MANNA, University of California San Diego, R. HERDER, Argonne National Laboratory, O.G. SHPYRKO, ERIC FULLERTON, University of California San Diego, EDWIN FOHTUNG[1], New Mexico State University — Exceptional optoelectronic properties with applications in plasmonics, biosensing, and cancer therapy have been manifested by transition metal nanostructures. New nanostructure synthesis techniques have enabled precise control over the sizes/shapes of metal nanoparticles, leading to exotic morphologies that cannot be properly characterized using standard techniques. The optical response of these nanoparticles is size/shape dependent and locally variable. This sensitivity to morphology makes precise control over the growth of these nanoparticles and knowledge of their external/internal structures essential. One example is five-fold-twinned decahedral and icosahedral Au nanoparticles; which are strained as a result of their geometry. We present a detailed analysis of the local structure of a single Au nanoparticle by mapping the strain field from Coherent X- ray Bragg diffraction patterns. Our results confirm the presence of a disclinations within the structures consistent with the commonly accepted strain model, we however observe shear gradients. A comparison of the retrieved strain fields with finite-element calculations demonstrates the effects of elastic anisotropy on the strain state of these particles.

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Date submitted: 23 Sep 2013 Electronic form version 1.4