Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Viscoplasticity and granularity in films of colloidal nanocrystals
DONGYUN LEE, SHENGGUO JIA, SARBAJIT BANERJEE, JOZE BEVK, IRVING HERMAN, JEFFREY KYSAR, Materials Research Science and Engineering Center, Columbia University — Thin films composed of colloidal CdSe nanocrystals have been electrophoretically deposited onto Au/Si substrates with thicknesses ranging from 300 to 3200 nm. The mechanical properties of these films have been measured by nanoindentation. Indentation is carried out to 25% of total thickness of the films, and the elastic modulus and hardness of the films are measured at 10% of the total film thickness to minimize substrate effects. In addition, the force is held at peak load for up to 20 s to observe the creep behavior of the films. The elastic modulus and hardness of 3.2 nm nanocrystal films are ∼10 GPa and ∼450 MPa, respectively. Furthermore, after particle cross-linking and partial ligand removal, the films exhibit compaction of the cores. This mechanical response suggests these nanocrystal films have polymeric features that can be attributed to the organic ligands and granular characteristics due to the inorganic cores. Both characteristics have also been confirmed by investigating larger nanocrystals and by removing the capping ligands. This work was supported primarily by the MRSEC Program of the NSF under Award No. DMR-0213574 and by NYSTAR. Nanoindentation studies at the Oak Ridge National Laboratory SHaRE User Center were sponsored under DE-AC05-00OR22725.

Joze Bevk
Materials Research Science and Engineering Center, Columbia University

Date submitted: 22 Nov 2006 Electronic form version 1.4