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Mapping Elastic Strain in Electrophoretically-Deposited CdSe Nanocrystal Films IRVING HERMAN, SARBAJIT BANERJEE, SHENGGUO JIA, DAE-IN KIM, RICHARD ROBINSON, JEFFREY KYSAR, JOZE BEVK, Materials Research Science and Engineering Center, Columbia University, New York, NY — The mechanical stability of nanocomponent films is critical for applications and yet is a largely unexplored area of research. Raman microprobe analysis has been used to probe elastic strain in the cores of thick, fractured electrophoretically-deposited CdSe nanocrystal films. Strain in these films arises from solvent evaporation and can be as much as 2.5% in the cores of CdSe nanocrystals for 3.2 μm thick films. The overall strain in these films, as determined by optical microscopy, is $\sim$11.7%. The in-plane stress developed in these films is $\sim$1.6 GPa. The biaxial modulus of the films is determined to be $\sim$13.8 GPa. Using micromechanics models, a value of $\sim$5.1 GPa is inferred for the biaxial modulus of the trioctylphosphine oxide ligand matrix. Since, solvent loss leads to strain in most ensembles of colloidal nanocrystals, this method has the potential for being broadly generalizable to other films made of nanocrystalline components. Support for this work was provided by the Materials Research Science and Engineering Center of the NSF under Grant No. DMR-0213574 and by NYSTAR.

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