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Mechanical Properties of Electrophoretically-Deposited CdSe Nanocrystal Films SHENGGUO JIA, SARBAJIT BANERJEE, DONGYUN LEE, WEI WANG, JOZE BEVK, JEFFREY KYSAR, IRVING HERMAN, MATERIALS RESEARCH SCIENCE AND ENGINEERING CENTER, COLUMBIA UNIVERSITY, NEW YORK, NY TEAM — Approaches to measuring and then minimizing the strain in electrophoretically deposited CdSe nanocrystal films are investigated. The films are seen to fracture above a critical thickness which vaies with nanocrystal size. Cracking and delamination have been studied by SEM and AFM and are attributed to the high strain energy in the film. Raman microprobe scattering and EDX mapping show the strain distribution in the nanocrystal films. The Young's modulus measured by nanoindentation is in good agreement with the parameters obtained from Raman scattering. The deposition conditions have been varied to minimize this strain, which is thought to be due to the evaporation of residual hexane solvent after electrophoretic deposition. In situ observations confirm this assumption about the origin of film strain. Thermogravimetric analysis and differential scanning calorimetry measurements provide the chemical composition of CdSe nanocrystals. The CdSe nanocrystal films become mechanically stronger and more resistant to chemical dissolution after being treated by different cross-linker molecules. This work was supported primarily by the MRSEC Program of the National Science Foundation under Award No. DMR-0213574 and by the NYSTAR.

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