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Morphology and transport properties of self-assembled, ligand-exchanged PbSe nanocrystal arrays CHING-TZU CHEN, IBM Thomas J Watson Research Center, WEON-KYU KOH, CHRISTOPHER MURRAY, Department of Chemistry, University of Pennsylvania, CHANG C. TSUEI, IBM Thomas J Watson Research Center — Self-assembled PbSe nanocrystal (NC) arrays have shown strong potential as a viable candidate for producing large-scale quantum dot superlattices. Such superlattices not only have significant technological implications, but they also serve as a model system for simulating strongly correlated transition-metal oxides. At present, highly-ordered PbSe NC arrays can be reproducibly prepared on structured Si-substrates by drop-casting PbSe solution in controlled environments. The as-grown superlattice films are nearly insulating, and post-processing ligand exchange is necessary to induce conduction. However, the lack of understanding of the ligand exchange processes has been a bottleneck to reliably producing highly-ordered conductive arrays. In this talk, we report on in-depth characterizations of the PbSe NC films treated with various ligand molecules in different solvents. The effect of a range of ligands and solvents on the film morphology will be discussed in details. Preliminary temperature-dependent transport and noise studies will be presented.

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