Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Size- and Shape-dependent efficiency of PbSe nanocrystal and nanowire doped organic semiconductor photovoltaics WENTING LI, CHRISTOPHER MURRAY, Department of Chemistry, CHERIE KAGAN, Department of Electrical and Systems Engineering, University of Pennsylvania —
Hybrid solar cells based on nanocomposite organic semiconductors and IR sensitive PbSe nanocrystals (NCs) and nanowires (NWs) are fabricated and serve as a model system to test in PV devices. Wet chemical routes are used to synthesize PbSe NCs tunable in size, from 6 to 12nm in diameter, and in shape by tailoring the reaction temperature and selection of surfactants. PbSe NWs are also synthesized through oriented attachment in solution of NC building blocks to form straight, zigzag, helical, and branched NWs. We integrate PbSe NCs and NWs with the organic semiconductors P3HT and pentacene. We are able to fabricate organic-inorganic bulk heterojunctions with pentacene using a solution-processable precursor that is thermally converted to pentacene. We investigate the role of the organic semiconductor pentacene in the solar cell, both as a conductivity booster and as a more stable alternative to P3HT. We find that ligand exchange significantly increases photocurrent by replacing oleic acid ligands used in NC synthesis with shorter pyridine or octylamine ligands. We also report that tailoring the size and shape of the NCs and controlling the deposition and annealing conditions of the nanocomposites enhances the solar cell performance.

Wenting Li
Department of Chemistry

Date submitted: 21 Nov 2008 Electronic form version 1.4