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Tuning the Height of the Tunnel Barrier in Colloidal Semiconductor Nanoparticle Films VENDA PORTER, SCOTT GEYER, JONATHAN HALPERT, MOUNGI BAWENDI, Department of Chemistry, Massachusetts Institute of Technology, TAMAR MENTZEL, MARC KASTNER, Department of Physics, Massachusetts Institute of Technology — Much of the work in the field of charge transport through arrays of semiconductor nanoparticles has focused on improving the conductivity by tuning the organic ligand spacer between particles. We present a study in which we enhance the conductivity in nanoparticles films by instead tuning the energetic height of the tunnel barrier by removing the organic ligand spacer and tuning the inorganic shell around each particle. Experimentally, we modify the height of the tunnel barrier by depositing an array of core/shell nanoparticles and burning away all of the organic ligands. The height of the tunnel barrier is now the energy difference between the conduction band of the core and the conduction band of the shell, rather than the much larger energy difference between the conduction band of the nanoparticle and the LUMO of the organic ligand. In addition, this method may reduce the impact of surface states on conductivity as the shell may provide better passivation than organic ligands that may leave surface trap sites unbound. These unpassivated sites can trap charge carriers, lowering the mobility in nanoparticles films. The reduction of charge trapping is also critical to raising the efficiency of nanoparticle solar devices.

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