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Plasma Synthesis of Silicon Nanocrystals for Ligand-less Colloidal Stability LANCE WHEELER, UWE KORTSHAGEN, University of Minnesota — Colloidal synthesis of prevailing semiconductor nanocrystals (NCs) requires long-chain organic ligands that provide steric stabilization. As these ligands hinder charge carrier transport when NCs are cast into thin films, significant efforts have focused on ligand exchange or removal schemes either in solution or during film assembly. Here we present a new mechanism to produce stable NC colloids without the need for any ligands. Silicon NCs are tailored in a gas phase plasma approach with a heterogeneous chlorine/hydrogen surface coverage to achieve an acidic surface. When the NCs are dispersed in solvents with hard donor groups, acid-base surface interactions induce stabilizing solvation layer around the NCs. In a set of experiments, electrostatic and steric stabilization are ruled out and evidence for the solvation layer formation is found. A set of criteria to achieve NC solvation is developed. Crack-free electronically coupled NC films are produced from these ligand-less NC colloids.

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