Abstract Submitted
for the GEC16 Meeting of
The American Physical Society

Synthesis of epitaxially grown core/shell nanocrystals with nonthermal plasmas[1] KATHARINE HUNTER, JACOB HELD, ANDRE MKHOYAN, UWE KORTSHAGEN, University of Minnesota — Nonthermal plasmas have gained increasing adoption as capable sources of nanocrystal materials that are challenging to grow in solution due to the high synthesis temperatures required. To date, little progress has been made to grow core/shell nanocrystals with nonthermal plasmas. In colloidal synthesis, core/shell structures have proven to be indispensable to improve the optical properties of nanocrystal materials. The epitaxially grown shells terminate surface states on the nanocrystal cores and can be selected to form heterojunctions that confine charge carriers in the core region. Here, we present the nonthermal plasma synthesis of germanium (Ge) nanocrystals with epitaxially grown silicon (Si) shells. Core/shell growth is achieved in a single flow-through plasma reactor by first injecting the core precursor and, after its depletion, injecting the shell precursor further downstream. Electron microscopy studies confirm epitaxial shell growth with minimal intermixing of core and shell material. Due to the lattice mismatch between core and shell, we find that Ge cores are compressively strained, which enables tuning of the Ge band structure via shell thickness. This demonstration of core/shell nanocrystals can be extended to an exciting array of heterostructures.

[1]This work was supported by the MRSEC program of the U.S. National Science Foundation under grant DMR-1420013

Uwe Kortshagen
Retired

Date submitted: 01 Aug 2016 Electronic form version 1.4