Abstract Submitted
for the GEC06 Meeting of
The American Physical Society

Synthesis of highly monodisperse Ge crystals in a capacitively coupled flow through reactor for photovoltaic applications[1] RYAN GRESBACK, UWE KORTSHAGEN, University of Minnesota — Germanium nanocrystals are interesting candidates for quantum dot-based solar cells. While the band gap of bulk Ge is ∼0.7 eV, the energy gap can be increased due to quantum confinement to ∼ 2eV for Ge particles of ∼3 nm in size. With a single material, Ge nanocrystals of sizes from 3 -15 nm would thus allow to span the entire range of band gaps that is of interest for photovoltaic devices. Moreover, compared to many other quantum dot materials that are currently studied for photovoltaic applications, Ge is perceived as non-toxic and environmentally benign. Ge nanocrystals are synthesized in a tubular, capacitively coupled flow through reactor. Germanium tetrachloride is used as a precursor. It is introduced into the plasma by a flow of argon and hydrogen. At typical pressures of 2 Torr and 40 W of RF power at 13.56 MHz, Ge crystals are generated and reside in the plasma for several tens of milliseconds. The size of the nanocrystals can be controlled in a range from 3-20 nm through the residence time. Particles are highly monodisperse. Organically passivated Ge nanocrystals self-assemble into monolayers when cast from colloidal solutions.

[1]This work is supported by NSF under MRSEC grant DMR-0212302, and by the Initiative of Energy and the Environment under grant IREE LG-C5-2005.

Uwe Kortshagen
University of Minnesota

Date submitted: 16 Jun 2006 Electronic form version 1.4