Abstract Submitted
for the GEC12 Meeting of
The American Physical Society

Plasma Crystallization of Silicon Nanoparticles[1] REBECCA ANTHONY, NICOLAAS KRAMER, Department of Mechanical Engineering, University of Minnesota, ERAY AYDIL, Department of Chemical Engineering and Materials Science, University of Minnesota, UWE KORTSHAGEN, Department of Mechanical Engineering, University of Minnesota — Using nonthermal plasmas for synthesis of silicon nanocrystals is well-established. However, nanoparticle heating in the plasma, which leads to particle crystallinity, is poorly understood. The mechanism behind heating of these particles has only been studied through modeling. In-situ measurement of particle temperature during plasma processes is difficult, but particles themselves can serve as thermometers, as their crystallinity will change depending on heating in the plasma. Here we investigate the heating and crystallization of nanoparticles using a double-plasma configuration, examining both the particles and the plasma. Amorphous silicon nanoparticles are formed in a low-power plasma, then injected into a separate plasma which is operated with variable power. Nanoparticle characterization confirms that crystallization of the particles occurs at a threshold power to the secondary plasma, around 30W (nominal) for 5nm particles. Optical emission spectroscopy on the plasma provides estimates of the electron temperature during nanoparticle crystallization, and capacitive probe measurements reveal ion densities at varying plasma powers. We will compare our outcomes to previous modeling results to build a complete picture of nanoparticle heating in plasmas.

[1]This work is supported by the DOE Plasma Science Center and DOE grant DE/SC-0002391.

Rebecca Anthony
Department of Mechanical Engineering, University of Minnesota

Date submitted: 15 Jun 2012 Electronic form version 1.4