Abstract Submitted
for the GEC16 Meeting of
The American Physical Society

Synthesis of Silicon Nanoparticles in Inductively Coupled Plasmas[1] ARAM H. MARKOSYAN, University of Michigan, ROMAIN LE PICARD, STEVEN L. GIRSHICK, University of Miinesota, MARK J. KUSHNER, University of Michigan — The synthesis of silicon nanoparticles (Si-NPs) is being investigated for their use in photo-emitting electronics, photovoltaics, and biotechnology. The ability to control the size and mono-disperse nature of Si-NPs is important to optimizing these applications. In this paper we discuss results from a computational investigation of Si-NP formation and growth in an inductively coupled plasma (ICP) reactor with the goal of achieving this control. We use a two dimensional numerical model where the algorithms for the kinetics of NP formation are self-consistently coupled with a plasma hydrodynamics simulation [1]. The reactor modeled here resembles a GEC reference cell through which, for the base case, a mixture of Ar/SiH_4 =70/30 flows at 150 sccm at a pressure of 100 mTorr. In continuous wave mode, three coils located on top of the reactor deliver 150 W. The electric plasma potential confines negatively charged particles at the center of the discharge, increasing the residence time of negative NPs, which enables the NPs to potentially grow to large and controllable sizes of many to 100s nm. We discuss methods of controlling NP growth rates by varying the mole fraction and flow rate of SiH_4, and using a pulsed plasma by varying the pulse period and duty cycle. [1] R. Le Picard, A.H. Markosyan, D. Porter, S.L. Girshick, M.J. Kushner, Plasma Chem. Plasma Proc. 36, 941 (2016).

[1]Work supported by DOE Office of Fusion Energy Science and National Science Foundation.

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Date submitted: 09 Jun 2016 Electronic form version 1.4