Abstract Submitted
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Capacitively Coupled RF Plasmas for the Synthesis of Silicon Nanocrystals: Scaling and Mechanisms[1] ARAM H. MARKOSYAN, U. Michigan, ROMAIN LE PICARD, DAVID H. PORTER, STEVEN L. GIRSHICK, U. Minnesota, MARK J. KUSHNER, U. Michigan — Silicon nanocrystals (SNCs) are of interest for light emitting electronics, photovoltaics, and biotechnology. SNCs are produced in low pressure capacitively coupled plasmas (CCPs) sustained in SiH_4 containing mixtures. To optimize these applications, it is necessary to control the size distribution of the SNCs. Particles 3-5 nm diameter are typically tailored by flow rates and power, however the fundamental processes responsible for this size control are not well understood. We developed a 2-d computer model for RF powered CCPs to predict the synthesis of SNCs. An aerosol sectional model was incorporated into the Hybrid Plasma Equipment Model. The reactor [1] is a quartz tube a few mm in diameter through which 100 sccm Ar and 15 sccm He/SiH_4 =95/5 at 2 Torr are flowed. The SNC residence time is 1-2 ms in the dense plasma region near the electrodes. We found that the distribution of plasma potential is important in determining the growth and size distribution of the SNCs. The SNCs having long residence times in the plasma, thereby enabling growth, are usually negatively charged. To ultimately allow these SNCs to flow out of the plasma, the distribution of the plasma potential must enable the particles to be entrained in the neutral gas flow without a significant potential barrier. We also found that agglomeration of particles of <1 nm is important in the rate of growth of SNCs. [1] L. Mangolini, et al. Nano Lett. **5**, 655 (2005).

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