Abstract Submitted
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Numerical simulation of capacitively coupled RF plasma flowing through a tube for the synthesis of silicon nanocrystals[1] ROMAIN LE PICARD, University of Minnesota, SANG-HEON SONG, University of Michigan, DAVID PORTER, Minnesota Supercomputing Institute, MARK KUSHNER, University of Michigan, STEVEN GIRSHICK, University of Minnesota — Silicon nanocrystals (SiNCs) are of interest for applications in the photonics, electronics, and biomedical areas. Nonthermal plasmas offer several potential advantages for synthesizing SiNCs. In this work, we have developed a numerical model of a capacitively coupled RF plasma used for the synthesis of SiNCs. The plasma, consisting of silane diluted in argon at a total pressure of about 2 Torr, flows through a narrow quartz tube with two ring electrodes. The numerical model is 2D, assuming axisymmetry. An aerosol sectional model is added to the Hybrid Plasma Equipment Model developed by Kushner and coworkers. The aerosol module solves for aerosol size distributions and size-dependent charge distributions. A detailed chemical kinetic mechanism considering silicon hydride species containing up to 5 Si atoms is used to model particle nucleation and surface growth. The sectional model calculates coagulation, particle transport by electric force, neutral drag and ion drag, and particle charging using orbital motion limited theory. Simulation results are presented for selected operating conditions, and are compared to experimental results.

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