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Numerical Modeling of an RF Argon-Silane Plasma with Dust Particle Nucleation and Growth[1] STEVEN GIRSHICK, PULKIT AGARWAL, Department of Mechanical Engineering, University of Minnesota — We have developed a 1-D numerical model of an RF argon-silane plasma in which dust particles nucleate and grow. This model self-consistently couples a plasma module, a chemistry module and an aerosol module. The plasma module solves population balance equations for electrons and ions, the electron energy equation under the assumption of a Maxwellian velocity distribution, and Poisson's equation for the electric field. The chemistry module treats silane dissociation and reactions of silicon hydrides containing up to two silicon atoms. The aerosol module uses a sectional method to model particle size and charge distributions. The nucleation rate is equated to the rates of formation of anions containing two Si atoms, and a heterogeneous reaction model is used to model particle surface growth. Aerosol effects considered include particle charging, coagulation, and particle transport by neutral drag, ion drag, electric force, gravity and Brownian diffusion. Simulation results are shown for the case of a 13.56 MHz plasma at a pressure of 13 Pa and applied RF voltage of 100 V (amplitude), with flow through a showerhead electrode. These results show the strong coupling between the plasma and the spatiotemporal evolution of the nanoparticle cloud.

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