Abstract Submitted
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Reactor Scale Modeling of Nanoparticle Growth in Low Temperature Plasmas[1] JORDYN POLITO, STEVEN LANHAM, University of Michigan, HIMASHI ANDARAARACHCHI, ZHAOHAN LI, ZICHANG XIONG, UWE KORTSHAGEN, University of Minnesota, MARK J. KUSHNER, University of Michigan — Low temperature dusty plasmas are an alternative to gas-thermal and liquid phase technologies for nanoparticle synthesis. Nanoparticles grown in plasmas have a wide variety of controllable properties that can be tuned by changing plasma parameters. Understanding synergistic effects of nanoparticle growth in plasmas could aid in rapid development of new materials. Modeling these systems has been challenged by the complexity and computational expense of particle-based or sectional-based approaches. In this work we describe a fluid-based computational approach to investigation of plasma based nanoparticle growth. The Hybrid Plasma Equipment Model (HPEM), a 2D reactor scale simulator, was adapted to enable reactions having growing particles. Modifications to the model self-consistently track particle mass and diameter evolution. The demonstration system examines Si nanoparticle growth in an argon inductively-coupled-plasma sustained in a flow tube (pressure tens to hundreds mTorr, diameter <1 cm) in which SiH_4 is injected [1]. Results for trends in silicon nanoparticle particle growth as a function of operating parameters such as gas flow rate and power deposition will be discussed. [1] U. Kortshagen et al. Chem. Rev. 116, 11061 (2016).

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