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Hybrid simulation of nanoparticle growth and transport in a pulsed RF CCP sustained in silane[1] WEN-ZHU JIA, YUAN-HONG SONG[2], YOU-NIAN WANG, PSEG, Dalian University of Technology — A pulsed RF silane plasma is studied numerically by adopting a self-consistent one-dimensional fluid/MC model. The large anions (typically Si12H25- and Si12H24-) in the discharge are the main precursors in the pathways leading to particle formation in a nucleation process. In order to study detailed growth of nanoparticles, an aerosol general dynamics equation is introduced and self-consistently coupled to the plasma fluid model, in which spatial distribution of nanoparticles, from several to tens of nm in diameter, is investigated. The numerical results show that, the ion drag force on smaller nanoparticles could to some extent exceed the electrostatic force in the plasma bulk, making the nanoparticles generally move towards the plasma boundaries. So the axial spatial distribution of nanoparticles is like a bimodal structure. With increase of the particle size, the distance between two peaks gradually becomes larger, reflecting the appearance of void in the plasma. At the same time, the presence of nanoparticles can lead to a decline of the electron density and a rise of the potential. In addition, by pulsing the RF source, size-controlled nanoparticles are expected to be extracted from the bulk plasma during the afterglow period.

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