Modeling Analysis of SiC CVD in the Horizontal Hot Wall Reactors

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Reaction-transport model of silicon carbide chemical vapor deposition is applied to simulation of SiC growth in horizontal hot wall reactors using SiH_4 and C_3H_8 as precursors and H_2 as carrier gas. Flow dynamics and heat transfer, mass transport of chemically reacting gas mixture, gas-phase and surface chemical reactions are considered. Compared to models previously reported in the literature, significantly reduced set of gas-phase chemical reactions is used. Surface chemistry model combines kinetic and thermodynamic description of heterogeneous reactions. At low temperatures growth rate is assumed to be controlled by desorption of molecular hydrogen from the surface. Effect of total flow rate on growth rate and uniformity is analyzed. Importance of 2D/3D consideration of transport processes and kinetic limitations of deposition in low temperature susceptor zone are discussed. Results of simulation are compared to experimental data on silicon carbide deposition rate and uniformity in the reactors of different modifications.