

Sensitivity Analysis of the Rapid Carbothermal Reduction Synthesis of Ultra-Fine Silicon Carbide Powders

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A non-dimensionalized and scaled non-isothermal model is developed for the "rapid carbothermal reduction" synthesis of submicron silicon carbide particles in an aerosol flow reactor to determine the minimum parametric representation of the system. Seven dimensionless groups are needed to completely describe the system, and these dimensionless groups are varied to determine the effects of the furnace wall temperature, inlet carbon crystallite size, carrier gas flow rate, and solids feed rate on final product quality. Sensitivity analysis shows that radiation dominates the heating process, sintering dominates the primary particle growth, and that conversion is controlled with precursor carbon particle size, wall temperature, and carrier gas flow rate.