Analysis of Iron Particle Growth in Aerosol Reactor Using A Discrete-Sectional Model

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A Discrete-Sectional model was used to simulate iron particles growth from the thermal decomposition $Fe(CO)_5$ in an aerosol reactor. Agglomerate size distribution, primary particle size, geometric mean diameter of agglomerates and geometric standard deviation were determined using the model. The effects of reactor temperature, initial reactant concentration and reactor residence time on the particle product characteristic were also studied. The importance of coalescence of primary particles within agglomerate and immediate coalescence of discrete particles within agglomerate on collision were also studied. Mass fractal dimension was used in the coagulation equation for the entire size distribution to consider the effect of fractal shape of agglomerates on the collision rate. The model incorporates two sets of coupled differential equations: one for agglomerate volume concentration and the other for agglomerate surface area concentration which are solved simultaneously. The coalescence among the neighboring primary particles instead of all the primary particles within an agglomerate was considered. Model prediction was compared with experimental data.