

Preparation and Characterization of Alumina-Precursor Powders by Gas-Phase Hydrolysis of AlCl_3

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In the present study, AlCl_3 was hydrolyzed in an aerosol reactor to produce spherical alumina-precursor ($\text{AlO}_x\text{Cl}_y(\text{OH})_z$), based on the AlCl_3 vapor hydrolysis kinetics. The alumina-precursor was then calcined to produce γ -alumina used for ceramic-grade alumina. The kinetics of AlCl_3 hydrolysis was studied in a batch reactor. The reaction variables were the $\text{H}_2\text{O}/\text{AlCl}_3$ molar, the reaction temperature, and the AlCl_3 concentration. An overall reaction rate equation involving four kinetic parameter, $-r_{\text{HCl}} = (\text{Ae}^{-E/RT})C_{\text{AlCl}_3}C_{\text{H}_2\text{O}}/(1 + C_{\text{H}_2\text{O}})$ was proposed. and were determined to be $1.85 \times 10^9 \text{ L}^{2.27}/\text{mol}^{2.27}\cdot\text{s}$, 35.8 kJ/mol, 2.27 and 873.7 L/mol respectively, by nonlinear regression to best fit measured HCl concentrations.

AlCl_3 was partially hydrolyzed in an aerosol reactor at a temperature of 300 to 700°C to produce spherical alumina-precursor, which can be represented as $\text{AlO}_x\text{Cl}_y(\text{OH})_z$. The obtained alumina-precursor were spherical, loosely agglomerated, and distributed in the size range of 50 to 300 nm. The alumina-precursor was calcined at 1200°C to obtained an γ -alumina.