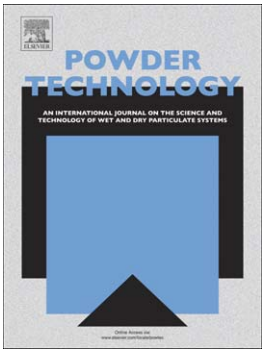

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Feasibility of using a rotating packed bed with blade packings to produce ZnO nanoparticles

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Abstract

A rotating packed bed (RPB) with blade packings was used to produce zinc oxide (ZnO) nanoparticles by precipitation. Precursors were firstly produced in a continuous liquid-liquid reaction of zinc chloride ($ZnCl_2$) with sodium hydroxide (NaOH). The effects of the concentrations of $ZnCl_2$ and NaOH, the flow rates of aqueous $ZnCl_2$ and NaOH, and the rotational speed on the size of the precursors were studied. Experimental results indicate that increasing concentrations of $ZnCl_2$ and NaOH, decreasing flow rates of aqueous $ZnCl_2$ and NaOH, and decreasing the rotational speed reduced the size of the precursors. The smallest precursors were produced at a $ZnCl_2$ concentration of 0.4 mol/L, an NaOH concentration of 0.8 mol/L, flow rates of aqueous $ZnCl_2$ and NaOH of 0.3 L/min, and a rotational speed of 600 rpm. Then, the precursors were calcined at 400°C for 1 h to generate ZnO nanoparticles with a mean size of 43 nm and a narrow size distribution. The detailed characterizations revealed that the as-produced ZnO nanoparticles were pure ZnO, which comprised a highly crystalline hexagonal wurtzite phase and exhibited a favorable optical property.

Keywords: Rotating packed bed; ZnO; Nanoparticles; Precipitation