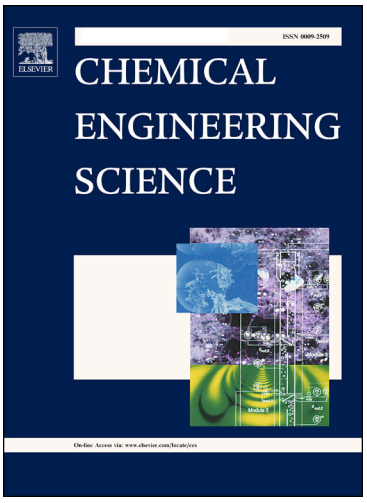

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Abstract

The rotary kiln is an essential device in chemical and metallurgical industries, with applications in a wide range of solids manufacturing processes. In particular, in the preparation of industrial chemical catalysts, the kiln has become a popular reactor for continuous calcination of catalysts ranging from millimeter-sized extrudates to micron-sized powders. As granular and powder flow behaviors are difficult to characterize, the design and scale-up of rotary calcination processes are often performed empirically. The goal of this research is to improve the fundamental understanding of powder flow in rotary kilns to aid in optimization of the continuous calcination process. For successful calcination to occur, the residence time of the particles must exceed the time required for heating and subsequent treatment. For uniform treatment of the feed, the particles must also exhibit low axial dispersion. In this work, the mean residence time and axial dispersion coefficient for a cohesive fluid catalytic cracking powder were determined in a pilot plant kiln by measuring the residence time distribution. This study utilized a pulse test developed by Danckwerts. Results were fit to the Taylor solution of the axial dispersion model and compared to the Sullivan prediction for mean residence time. It was found that the mean resident time decreases as the feed rate, kiln incline, and rotation rate increase. It