

Ye Sheng, MEng, "Instantaneous Measurements on the Hydrodynamics in Gas-Solid Circulating Fluidized Bed Riser", The University of Western Ontario, August 2007.

Abstract:

A good understanding on the hydrodynamics in circulating fluidized beds is necessary to further optimize and improve the design of existing industrial Fluidized Catalytic Cracking (FCC) riser reactors and to provide more information for Circulating Fluidized Bed (CFB) modeling. With a novel optical fiber probe that can measure particle velocity and solids concentration simultaneously and instantaneously, extensive experiments were conducted to study the instantaneous solids concentration and particle velocity in a 15.1m long CFB riser of 100mm in diameter. This study analyzed the radial and axial distributions of solids concentration, particle velocity and their variations with nine operating conditions and at six axial levels. Instantaneous solids concentration and particle velocity were found to be well correlated on most of the radial positions. Instantaneous solids flux was defined as the product of instantaneous solids concentration, instantaneous particle velocity and particle density. In this study, the detailed time evolution, axial and radial distribution of instantaneous solids flux and the variation of solids flux with operating conditions were investigated. The instantaneous solids flux was found to have a strong fluctuation at radial position of $r/R=0.8\sim 0.9$. The local solids flux profile showed a flat shape with a maximum at near wall area under most operating conditions. The comparison of cross-sectional solids flux and solids circulation rate measured by measuring vessel showed a good match.