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Mojtaba Mokhtari, Jamal Chaouki

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New Technique for Simultaneous Measurement of the Local Solid and Gas Holdup by using Optical Fiber Probes in the Slurry Bubble Column

Mojtaba Mokhtari, Jamal Chaouki*

Department of Chemical Engineering, Ecole Polytechnique de Montreal, Montreal, QC, Canada

Abstract

Design and scale-up of the slurry bubble columns, as popular multiphase reactors, is complicated because of the complexity of the hydrodynamics of these types of reactors. In fact, to have a good design, precise information about the local hydrodynamic parameters are required. In this study, a new method is developed for simultaneous measuring of the local solid, gas and liquid holdup in the slurry bubble column. Optical fiber probes were used to measure phase distribution inside the bubble column. Our specific calibration procedure enables probes to measure solid concentration in the slurry phase as well. In order to examine the proposed measurement method, a cylindrical plexiglass column with 270 cm height and 29.2 cm diameter was utilized as the slurry column which contained water, glass beads, and air. The mean diameter of the glass beads is 35 μm and the experiments were done with 1% and 3% solid loading (volume solid/volume slurry). To cover both homogeneous and heterogeneous flow regime in the bubble column, air with a wide range of superficial gas velocity (0 to 22 cm/s) was injected into the slurry phase. The obtained results showed that the axial distribution of the solid particles is not uniform along the column, and a local minimum concentration observed in the middle of the column. In the homogeneous regime, the local solid concentration increased by raising the superficial gas

* Corresponding Author,
Email: jamal.chaouki@polymtl.ca