Thesis Title:

Microstructured Bubbling Bed: Hydrodynamics and its Application in Flotation

Abstract

Slurry bubble columns are widely used in various industries such as coal beneficiation, petrochemical, biochemical, wastewater treatment and chemical industries, etc. Slurry bubble columns are advantageous to use due to the ease of thermal control, the high interfacial contact between the phases, the low-pressure drop, the good productivity, the low construction cost, and the effective heat and mass transfer coefficients. Despite several studies of hydrodynamic characteristics of the circular and rectangular columns, there is a lack of understanding of the hydrodynamic behavior. Hence, the correct interpretation of the design parameters is essential for the proper design, operation, modeling, control, scale-up, and optimization of a processing unit. The complex nature of multiphase flow in the slurry bubble column is the result of the fluid flow that is affected by numerous design parameters. The slurry bubble columns are simple in construction; however, the scale-up technique is complicated because of the lack of adequate information on hydrodynamic characteristics. According to the literature, most of the experiments have been performed in the cylindrical column, which is known for the substantial backmixing of phases (both liquid and gas) which reduces the process efficiency, decreases the overall performance of the system. The microstructured column (2D with very small width) nowadays are gaining importance for the scientific community due to its ability to reduce the backmixing of the phases.

The present research focuses mainly on some important hydrodynamic characteristics (i.e., gas holdup, bubble size distribution, interfacial area, bubble aspect ratio, frictional pressure drop, bubble-slurry interfacial shear stress, mixing characteristics, induction time) and application (i.e., mineral beneficiation) in the semi-batch and counter-current two- and three-phase microstructured bubble column.

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