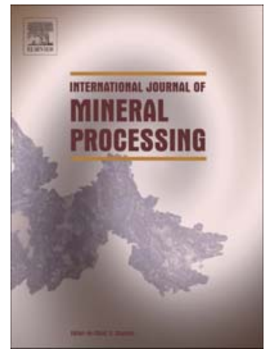
Accepted Manuscript



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PII: S0301-7516(16)30214-9
DOI: doi: 10.1016/j.minpro.2016.10.005
Reference: MINPRO 2968

To appear in: *International Journal of Mineral Processing*

Received date: 3 June 2016
Revised date: 21 October 2016
Accepted date: 25 October 2016

Please cite this article as: Vazirizadeh, Ali, Bouchard, Jocelyn, Chen, Yun, Effect of particles on bubble size distribution and gas hold-up in column flotation, *International Journal of Mineral Processing* (2016), doi: 10.1016/j.minpro.2016.10.005

Effect of particles on bubble size distribution and gas hold-up in column flotation

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Abstract

In flotation systems, it is generally assumed that the bubble size presents an inverse correlation with the gas hold-up. However, this hypothesis is not systematically true. The focus of this work is to study the effect of solid particles on the bubble size distribution and gas hold-up, as well as the correlation between the bubble size distribution and gas hold-up in column flotation. Experiments were conducted in two and three-phase systems using a laboratory flotation column (5.6 cm internal diameter, total height of 650 cm), and mixtures of quartz (hydrophilic gangue) and talc (naturally hydrophobic mineral), classified in four different size fractions. For the studied flotation system, experimental results are compared with literature correlations and models to reveal that hydrophobic particles affect the gas hold-up through three different mechanisms modifying the Sauter mean diameter and rise velocity, namely (1) surface interactions, and the joint antagonistic effect of (2) bubble loading and (3) coalescence.

Keyword: bubble size distribution, gas hold-up, column flotation, solid particles

Introduction

In flotation systems, gas dispersion plays a critical role for particle collection (recovery) and froth mass transport (selectivity). To evaluate this effect at the industrial scale, the bubble surface area flux (S_b) is typically estimated from the superficial gas rate (J_g) and bubble size distribution (BSD) measurements, where the complete BSD is compressed into a single value, i.e. the Sauter mean diameter (d_{32}). However, it is now criticized that (1) a given S_b value can be obtained from different combinations of J_g and d_{32} [Vinnett et al., 2012], and (2) a given d_{32} value can be obtained from different BSDs [Maldonado et al., 2008b]. A better approach consists in adequately parameterizing the overall BSD as presented by Vazirizadeh et al. [2015].