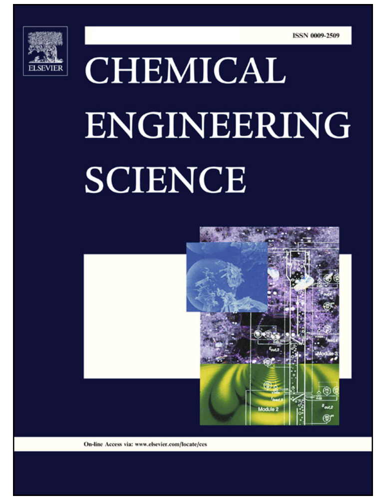

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X-ray imaging of horizontal jets in gas fluidised bed nozzles

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Abstract

The design of the fluidising air distributors, or nozzles, is one of the most important aspects influencing operation of fluidised beds at industrial scale. In this work, the study of the hydrodynamics in gas-solid fluidized beds where the primary gas injection is achieved through a nozzle-type gas distributor has been carried out, using an innovative X-ray imaging technique. Qualitative and quantitative results are reported, with particular focus on jets penetration length and their evolution. Results show that the lighter and the finer are the particles, the larger is the jet penetration. Since the experimental data do not match predictions available in literature, a new non-dimensional correlation based on hydrodynamic scaling and Froude number is also proposed. The new correlation takes into account the effects of jet velocity, particle density and particle size. A tentative mechanistic explanation for the departure from purely hydrodynamic scaling is offered.

1. Introduction

Gas distribution in fluidised beds may be accomplished with a variety of devices whose design, operational criteria and performance are widely addressed in the general fluidisation literature [1,2]. Nozzle type distributor has been found to be very effective for high temperature fluidised bed reactors and is the recommended type for most applications at industrial scale. Nozzles are usually screwed or welded to a flat horizontal plate which forms the roof of an air supply plenum chamber. If the nozzles are correctly spaced and the holes properly sized, this type of distributor gives excellent fluidisation and trouble-free operation for extended periods of service [1]. Due to the great impact jets have on the hydrodynamics and gas transfer within the bed, it is highly important to establish the