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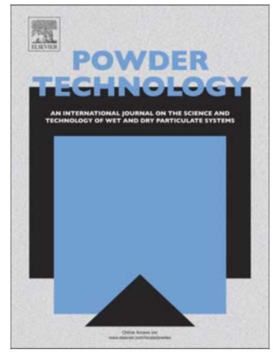

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PII: S0032-5910(17)31054-9
DOI: doi:10.1016/j.powtec.2017.12.094
Reference: PTEC 13083

To appear in: *Powder Technology*

Received date: 17 July 2017
Revised date: 14 November 2017
Accepted date: 30 December 2017

Please cite this article as: Justin M. Weber, Michael M. Bobek, Ronald W. Breault, Joseph S. Mei, Lawrence J. Shadle, Investigation of core-annular flow in an industrial scale circulating fluidized bed riser with electrical capacitance volume tomography (ECVT), *Powder Technology* (2018), doi:10.1016/j.powtec.2017.12.094

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ACCEPTED MANUSCRIPT

Investigation of Core-Annular Flow in an Industrial Scale Circulating Fluidized Bed Riser with Electrical Capacitance Volume Tomography (ECVT)

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Abstract
There is a paucity of riser data for industrial scale units, particularly with regard to the solids fraction. This is especially true for detailed spatially distributed values. To alleviate this problem, NETL installed a 0.445 m tall electrical capacitance volume tomography (ECVT) sensor 9.66 m from the gas distributor of its industrial size (15.45 m high and 0.3 m diameter) circulating fluidized bed (CFB) cold model. A series of tests were conducted to investigate the gas-solid flow behavior using high density polyethylene (PPE) solids. Static electricity was successfully minimized using Larostat and humidification. Time averaged radial solid fractions profiles are presented and discussed. The time and spatially averaged solid fractions measured by the ECVT agree well with estimates from the pressure drop. The annular thickness was measured and found to increase with increases in the solids flow rate and decrease with increases in the gas velocity. Comparisons of the annular thickness and solids fraction as determined from the ECVT unit were compared to existing correlations. The average error ranged from 13% to 275% which is not surprising since the literature correlations were developed from data on much smaller units and for significantly different particles.

Introduction
The use and implementation of fluidization can be found in many processes (chemical, petroleum, mineral, power generation, and pharmaceutical) to provide superior gas–solid contact compared to other methods [1] . The performance of circulating fluidized beds depends on the effectiveness of the riser. This motivates understanding the fundamentals of the hydrodynamics of the fluidization process, which is essential to the proper design, scale-up, and operation of a fluidized bed reactor in order to achieve good performance. Therefore, a great deal of effort has been dedicated to the fundamental understanding of the hydrodynamic behavior in a gas–solid fluidized bed through experimental measurements.

Understanding the fundamentals of gas-solid fluidization processes and, in general, multiphase flows has been a significant task since the conception of gas-solid fluidization and fluid particle systems. Various measurement techniques have been applied to better understand the fundamentals of these

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