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The effect of riser end geometry on gas-solid hydrodynamics in a CFB riser operating in the core annular and dilute homogeneous flow regimes

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Abstract

Riser hydrodynamics are a function of the flow rates of gas and solids as well as the exit geometry, particularly when operated above the upper transport velocity. This work compares the exit voidage for multiple geometries and two different solids: Geldart group A glass beads and Geldart group B coke. Geometries were changed by modifying the volume of an abrupt T-shaped exit above the lateral riser exit. This was accomplished by positioning a plunger at various heights above the exit from zero to 0.38 m. A dimensionless expression used to predict smooth exit voidage was modified to account for the effect of the depth of the blind-T. The new correlation contains the solids-gas load ratio, solids-to-gas density ratio, bed-to-particle diameter ratio, gas Reynolds Number, as well as a term for the exit geometry. This study also found that there was a minimum riser roof height above the blind-T exit beyond which the riser exit voidage was not affected by the exit geometry. A correlation for this minimum riser roof height has also been developed in this study. This study covered riser superficial gas velocities of 4.35 to 7.7 m/s and solids circulation rates of 1.3 to 11.5 kg/s.

Keywords: Riser, end effects, core annular flow

Introduction

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