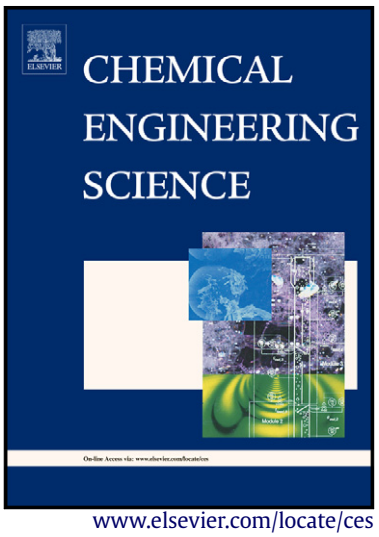


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# Investigation of gas-solids flow characteristics in a circulating fluidized bed with annular combustion chamber by pressure measurements and CPFD simulation

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**Abstract**

For large scale circulating fluidized bed (CFB) boilers, a new type of annular combustion chamber was proposed to improve the secondary air penetration and provide adequate space to arrange the heat transfer surface. To investigate the gas-solids flow characteristics and optimize the structure of the annular combustion chamber, a "cold" test rig was built with a cross sectional area of 1.18 $m^2$ and a height of 8.0 m. High frequency pressure transducers were used to obtain the pressure fluctuations characteristics. CFD simulation based on computational particle fluid dynamic (CPFD) was used to obtain pressure fluctuations and particles concentration. The time domain analysis, power spectrum analysis and Hilbert-Huang transform were applied to the experimental and simulation data. Different flow regimes including single bubble regime, exploding bubble regime and turbulent fluidization regime were identified. The flow characteristics were investigated in terms of standard deviation and higher-order moments, auto-correlation, power spectrum, and EMD energy entropy. The results show that the gas-solids flow in the bottom region of the annular combustion chamber was relatively uniform. The gas-solids flow in annular combustion chamber was proved similar to that in a conventional CFB riser.

**Keywords**: Circulating fluidized bed, Flow regimes, Pressure, CPFD simulation, Non-uniformity, Power spectrum

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