CFD SIMULATION OF HYDRODYNAMIC CHARACTERISTICS IN A MODIFIED INTERNALLY CIRCULATING FLUIDIZED BED MIXER

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A modified internally circulating fluidized bed (MICFB) was proposed as a particle mixer by coupling a pre-mixing section and a modified ICFB section[1]. Four slots were opened at the upside of the draft tube to improve further particle mixing. Hydrodynamics of MICFB was numerically investigated by multi-scale simulation based on a structure–dependent EMMS model[2].

Results showed that strong particle mixing mainly occurred in three regions, the bottom region, the draft tube region and the rectangular slots affected region. At the bottom region, due to the jet and the particles circulating from the annulus, bed density and particle velocity distributed unevenly. A cross-flow occurred in this region, with the circulating particles moving horizontally and the initial bubbles rising vertically. With increasing superficial gas velocity, particle rising velocity and particle circulating mass flow rate increased, leading to better particle mixing. In the slots affected region, radial distribution of bed density seems flat and the rising velocity decreased in the draft tube, while bed density significantly increased in the annulus. Nearly 62 wt. % particles entered the gas-solid separator region and then flowed into the annulus region, while the rest particles directly circulated into the annulus through the slots. A cross-flow of particles was also observed near the slots, with particles from the gas-solid separator region moving downwards and those circulating through slots flowing horizontally. Compared with ICFB with no slots, MICFB had a greater particle circulation mass flow rate with an increase of 20%, which consequently resulted in further particle mixing.

REFERENCES

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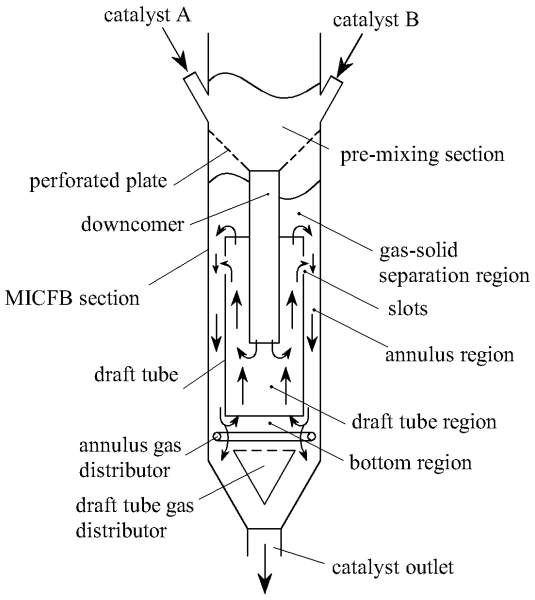

Figure . Schematic diagram of the modified internally circulating fluidized bed mixer