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Effects of liquid action mechanisms on hydrodynamics in liquid-containing gas-solid fluidized bed reactor

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Abstract

This study mainly investigated the effects of liquid evaporation and liquid bridge actions on hydrodynamics in liquid-containing gas-solid fluidized bed reactor (LGSFBR). A liquid flow-rate increasing process and a gas velocity decreasing process were studied by using temperature, acoustic emission (AE) and pressure fluctuation (PF) measurement techniques. When the liquid was added with lower flow-rates, particle circulation pattern was dominated by gas flow/liquid evaporation action, and thus particles display ascending at the center and descending near the wall (ACDW) with particle motion enhanced, meanwhile bubble sizes increased at the beginning and then decreased to steady values. With increasing liquid flow-rate or decreasing gas velocity, liquid bridge action relative to gas flow action intensity (LRGI) increased, and thus the particle circulation pattern gradually became dominated by the liquid bridge action. Specifically, the downward motion of dynamic particle agglomerations was enhanced while particle motion was weakened, and the gas bubble size was repressed gradually. Several unstable fluidization states would be caused by continuous increases in the liquid bridge action.

Key words: liquid-containing gas-solid fluidized bed reactor (LGSFBR); particle circulation pattern; liquid evaporation and bridge action; agglomerations; temperature profile