CFD SIMULATION OF THE INFLUENCE OF SUSPENSION SECTION ON THE HYDRODYNAMICS OF CFB RISER

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The gas-solid two-phase flow in a circulating fluidized bed (CFB) is affected by hydrodynamic factors (say, superficial gas velocity, solids flux, solids inventory) , material properties (say, particle diameter) and geometric factors such as the entry and exit configuration (1-5). For example, Li (5) found that the axial profile in a CFB is heavily dependent on the length of the suspension section, which refers to the part between the riser bottom and the recycle inlet of solids. The variation of the suspension section may result in exponentially decaying or S-shaped profiles. However, most of computational fluid dynamics (CFD) simulations, especially the 2D simulations, do not take into account this factor (6-8). In this work, we perform 3D, full-loop simulation of a CFB with different lengths of suspension section in the riser, as shown in Fig. 1. The simulation results reveal that the axial profiles in the riser with longer suspension section are more likely S-shaped, which is consistent with the literature (Fig. 2). This suggests a need of full-loop simulation of CFB to understand the complicated dependence of hydrodynamics on geometric factors.

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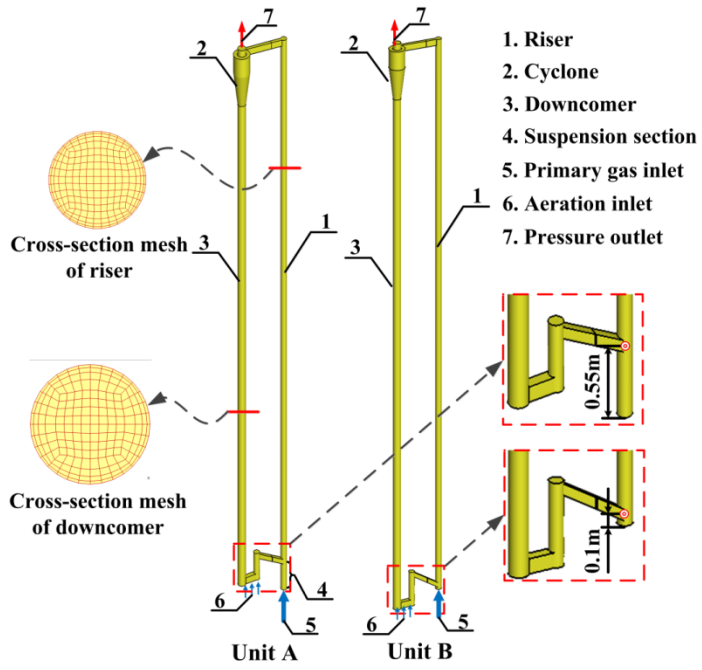

Figure 1. Schematic diagram of two CFBs with different suspension sections

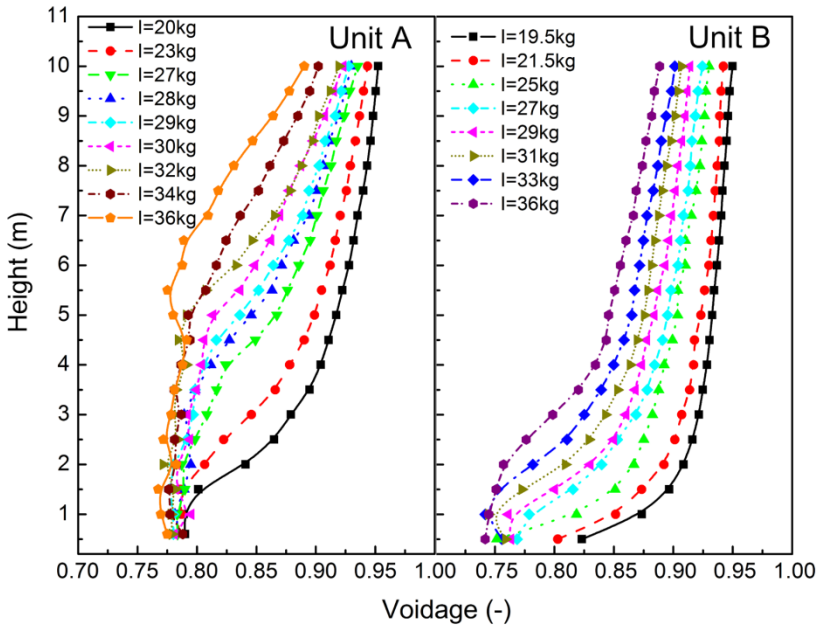

Figure 2. The axial profiles of cross-sectionally averaged voidage in two CFB risers with different solids inventories (ρ_p=930kg/m^3, ρ_g=1.1795kg/m^3, μ_g=1.8872×10^{-5}Pa·s, d_p =54μm, U_g=1.52m/s)