عنوان مقاله:

Modeling and Simulation of an Oxygen-Blown Bubbling Fluidized Bed Gasifier using the Computational Particle-Fluid Dynamics (CPFD) Approach

محل انتشار:

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خلاصه مقاله:

Fluidized beds are conventional components of many industrial processes, such as coal gasification for energy generation and syngas production. Numerical simulations help to properly design and understand the complex multiphase flows occurring in these reactors. Two modeling approaches are usually adopted to simulate multiphase flows: the two fluids Eulerian-Eulerian model and the continuous/discrete Eulerian-Lagrangian model. Since fluidized beds account for an extremely large number of particles, tracking each of them could not assure to get results within a reasonable computational time. The Computational Particle-Fluid Dynamics (CPFD) approach, which belongs to the Eulerian-Lagrangian models class, groups together particles with similar key parameters (e.g. composition, size) into computational units (parcels). Parcel collisions are modeled by an isotropic solid stress function, depending on solid volume fraction. In this paper, the bubbling fluidized bed (BFB) upstream gasifier of the EU research infrastructure ZECOMIX (Zero Emissions of Carbon with Mixed technologies) has been simulated using a CPFD approach via Barracuda® software. The effect of different fluidizing agent injection strategies on bed bubbling and mixing, for non-reacting cases, has been studied. The numerical results for a reacting case have been compared to the available experimental data, gathered during the coal gasification campaign. The model has proved to be very useful in the choice of the more efficient injection configuration that assures a more effective contact of the gas with the solid bed and a good bubbling fluidization regime, together with a satisfactory prediction of the outlet gas composition. The numerical approach has turned out to be robust and time-saving and allowed to dramatically reduce the computational cost with respect the classical two fluids Eulerian-Eulerian models.

کلمات کلیدی:

Fluidized bed gasifier, CPFD method, Multiphase flows

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