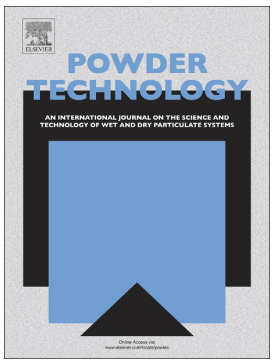

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Transient DEM-CFD Simulation of Solid and Fluid Flow in a Three Dimensional Blast Furnace Model

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Abstract

A numerical investigation of gas and solid flow as well as the liquid accumulation in a scaled Blast Furnace (BF) model was carried out using the discrete element method (DEM) coupled with computational fluid dynamics (CFD). This three dimensional simulation considers the interaction of the solid flow of a layered burden column with the counter flowing process gas. The influence of the cohesive zone is modelled by a material dependent permeability, the molten iron and the slag are considered as one additional liquid phase in the hearth. The method used is compared with a two dimensional numerical slot model presented in former publications by Zhou et al. and then applied to a different three dimensional setup. The comparison of the models exhibits considerable differences concerning the general multiphase flow behaviour. Moreover, it is shown that three dimensional models are required to correctly resolve the actual spatial flow structure and its influence on the shape of the coke free region in the hearth. Finally, the three dimensional model is used to show the influence of the liquid discharge on the stress distribution along the walls.

Keywords: ironmaking, blast furnace, discrete element method, computational fluid dynamics, multiphase flow