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Numerical Study on the Performance of Upgraded Victorian Brown Coal in an Ironmaking Blast Furnace

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Abstract : A 3D numerical model is developed to simulate the complicated in-furnace combustion phenomena in the lower part of an ironmaking blast furnace (BF) while using pulverized coal injection (PCI) technology to reduce the consumption of relatively expensive coke. The computational domain covers blowpipe-tuyere-raceway-coke bed in the BF. The model is validated against experimental data in terms of gaseous compositions and coal burnout. Parameters, such as coal properties and some key operational variables, play an important role on the performance of coal combustion. Their diverse effects on different combustion characteristics are examined in the domain, in terms of gas compositions, temperature, and burnout. The heat generated by the combustion of upgraded Victorian brown coal is able to meet the heating requirement of a BF, hence making upgraded brown coal injected into BF possible. It is evidenced that the model is suitable to investigate the mechanism of the PCI operation in a BF. Prediction results provide scientific insights to optimize and control of the PCI operation. This model cuts the cost to investigate and understand the comprehensive combustion phenomena of upgraded Victorian brown coal in a full-scale BF.

Keywords : blast furnace, numerical study, pulverized coal injection, Victorian brown coal
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