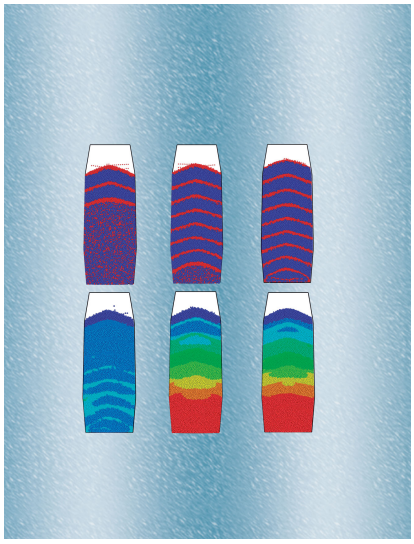

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Cover Photo:

This cover shows transient solid flow and temperature field in reduction shaft of COREX, obtained from an advanced combined approach of discrete element method and computational fluid dynamics. This development is a critical step for the establishment of a comprehensive thermo-chemical mathematical model of COREX. More details can be found in the manuscript by Q. F. Hou and co-workers on page 626.

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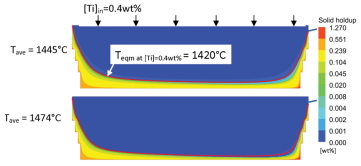

The addition of titania into the Blast Furnace may promote Ti-rich scaffolds along the damaged hearth lining. A Computational Fluid Dynamics model is used to investigate the solid particles formation behavior in the hearth during titania addition. Results show the profile of the particle rich layer along the hearth bottom matches well with the equilibrium temperature isotherm of the incoming hot metal solution.

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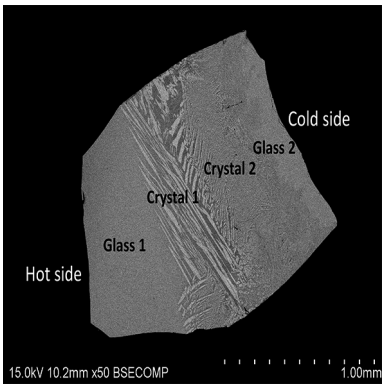
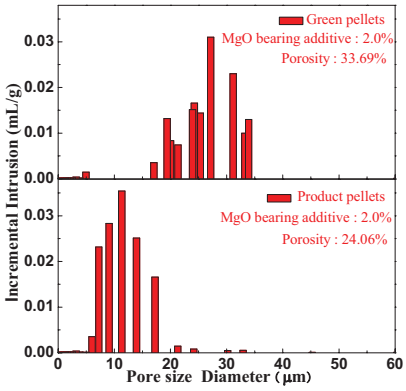
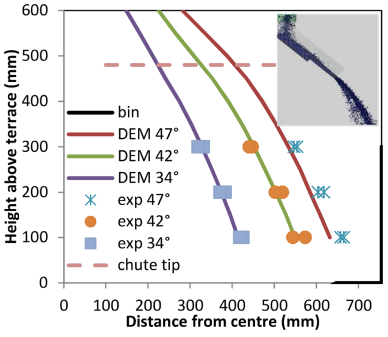


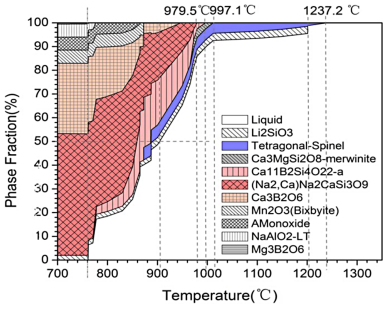
Crystallization behavior of a mold flux for low carbon steel casting is investigated using SHTT and DHTT. CCT and TTT diagrams indicate that the critical cooling rate is 7 °Cs^{-1} and the shortest incubation time is 15 s at 1000 °C. DHTT experiment suggests that the mold flux will establish a three-layer structure – glassy layer, crystalline layer and liquid layer in continuous casting operation.



The densification process of MgO bearing pellets are investigated. MgO addition has a negative effect on the densi®cation process of pellets. With the addition of MgO bearing additive from 0 to 2.0 %, the pore size and porosity of product pellets increases gradually, and the densification ratio of pellets decreases from 46.3 to 28.6%.



Blast furnace burden distribution phenomena are captured by DEM approach, including justification of surface properties of spheres, burden trajectories from the chute tip, and formation of burden layers in the throat region. Proper values for rolling and sliding friction are recommended. Sensitivity tests are conducted to reveal the significance of particle surface properties on burden layer formation.



This paper analyzes phase composition of fluoride-free mould fluxes containing B_2O_3, TiO_2, Na_2O, and MgO using the thermochemical software FACTSage. The phase equilibria of these boracic mould fluxes calculated are in reasonable agreement with the experimental phase characterization results and therefore can provide the guidance for boracic flux composition selection.

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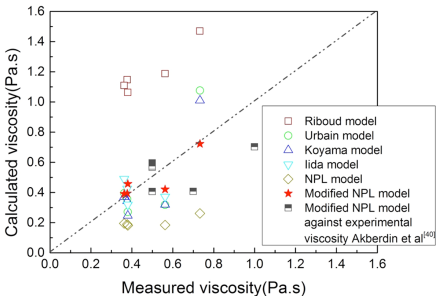
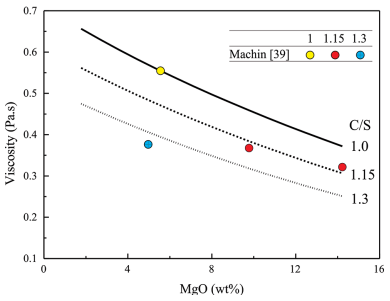
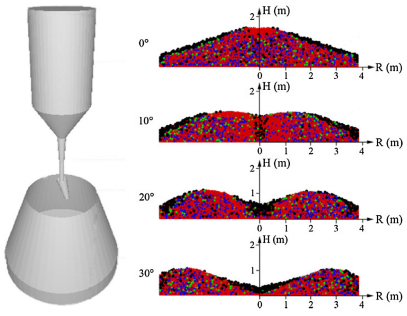


In this paper, the melting properties and viscosity of SiO_2–CaO–Al_2O_3–B_2O_3 fluxes were measured with a mass ratio of CaO/SiO_2 from 0.83 to 1.5 and B_2O_3 concentration from 5 to 9 wt%; flux viscosity was described using modified NPL model. The results of this investigation will provide basis for further development of fluorinefree boracic mould fluxes.



An improved viscosity model has been developed for blast furnace slag in SiO_2–Al_2O_3–CaO–MgO system. A large number of viscosity data has been collected and critically evaluated for the model optimization. This new model has a reduced number of equations and parameters compared to the original Urbain model. The predictions of this model show lowest deviation in existing viscosity models for blast furnace slags.



A 3D model of COREX-3000 shaft furnace with charging system is developed based on DEM to investigate the effects of distributor angles on the burden and gas distributions. The results suggest that the distributor angle should be no larger than 10° to control the central gas flow and be larger than 25° to prevent the peripheral gas from over developing.