The Effect of Iron Oxide on Sulfide Capacities of CaO-based Molten Slags

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ABSTRACT

Removing sulfur and phosphorus from molten iron can be expressed by the following reactions, respectively.

$$[S]_{Fe} + (O^{2-})_{slag} = (S^{2-})_{slag} + [O]_{Fe} \qquad (1)$$

$$[P]_{Fe} + (3/2)(O^{2-})_{slag} + (5/2)[O]_{Fe} = (PO_4^{3-})_{slag} \qquad (2)$$

Equations (1) and (2) indicate that desulfurization and dephosphorization have opposite oxygen potential conditions. If a small amount of desulfurization slag not removed is carried over to dephosphorization process, Reaction (1) proceeds toward left hand resulting in increasing sulfur content in molten iron. For better understanding of such re-sulfurization reaction in hot metal pre-treatments, the present study aimed at evaluating the effect of iron oxide on the sulfur distribution ratio between slag and hot metal. To measure sulfide capacities and FeO activities simultaneously at temperature below the melting point of pure iron, $CaO-SiO_2-FeO$ and $CaO-Al_2O_3-FeO$ ternary molten slags were brought into equilibria with copper-iron-sulfur liquid alloys, and the equilibrium oxygen partial pressures were determined with an electrochemical technique involving the stabilized zirconia solid electrolyte. The experimental results showed that the sulfide capacity increased with an increase in FeO content, and this trend was consistent with the fact that FeO was basic. Although the addition of FeO raised the FeO activity and oxygen potential, the calculated value for sulfur distribution ratio between slag and hot metal increased with increasing FeO content.