

Thermodynamics of Calcium Ferrite Slags at 1200 and 1300

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The Behaviour of Lead in Silica-Saturated, Copper Smelting Systems
G.H. KAIURA, K. WATANABE and A. YAZAWA
Canadian Metallurgical Quarterly, Vol.19, (1980), 191.

The equilibrium distribution coefficients of lead between the matte, slag and metallic phases in the silica-saturated, copper smelting system were determined. These experiments were carried out by simultaneously equilibrating the various phases in silica crucibles at 1300°C. The conditions investigated in this study ranged from iron and copper alloy saturation at low oxygen potentials to a sulfur dioxide partial pressure of 0.1 atm and up to a matte grade of 75 wt. % Cu. The lead was found primarily in matte except in the presence of the copper alloy phase. The accumulation of lead in the copper alloy phase was pronounced, particularly at low oxygen potentials. Under conventional smelting conditions, the lead content in slag increased with increasing matte grade. The behaviour of lead was explained by proposing metallic and sulfidic species in matte and oxidic and sulfidic dissolution in slag. In this manner, the activity coefficients of the various species were calculated in their respective phases.

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Canadian Metallurgical Quarterly, Vol.19, (1980), 297.

Oxygen isobars and liquidus isotherms of the system CaO-FeO-Fe₂O₃ at 1200 and 1300°C were determined by quenching samples equilibrated with CO₂-CO mixtures. The iron liquidus and the melt coexisting with two solids were carefully examined in terms of their composition as well as the equilibrium oxygen partial pressures, p_{O_2} . At 1200°C, p_{O_2} was $10^{-7.70}$ atm when the slag coexisted with magnetite and dicalcium ferrite. At 1300°C, the melt region extends to the CaO-Fe₂O₃ join, where p_{O_2} was $10^{-0.68}$ atm (air) or higher. Within the range of p_{O_2} from one order above that at iron saturation to 10^{-4} atm, the slag composition, p_{O_2} , and the temperature T are related by the equation: $\log(\text{Fe}^{+++}/\text{Fe}^{++}) \approx 0.170 \log p_{O_2} + 0.018(\text{wt } \% \text{ CaO}) + 5500/T - 2.52$. Activities of CaO(s), FeO(l), and Fe₃O₄(s) in the slag were calculated from the p_{O_2} data by combining the available thermal data and/or by Gibbs-Duhem equation.