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Sulfide capacity of CaO-CaF₂-SiO₂ fluxes

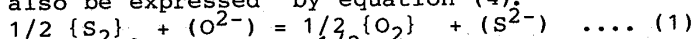
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1. Introduction: The fluxes used in the pretreatment of hot metal for desulfurization and dephosphorization are mainly based on lime or soda ash. In this investigation, some results concerning desulfurization potentialities of CaO-CaF₂-SiO₂ fluxes are shown from thermodynamic viewpoint. For the desulfurization reaction, represented by equation (1), the sulfide capacity of fluxes is defined⁽¹⁾ by equation (2). Since sulphur partial pressure can be calculated by equilibrium constant for the dissolution reaction of sulfur into molten metal, (3), the sulfide capacity can also be expressed by equation (4).



$$C_{S2} = \frac{\% (S^{2-}) \cdot (p_{O_2}/p_{S_2})^{1/2}}{\% [S]} \quad \dots (2)$$

$$\frac{1}{2} \{S_2\} = [S] \quad \dots (3)$$

$$C_{S2} = \frac{\% (S^{2-}) \cdot p_{O_2}^{1/2} \cdot K_3}{\% [S]} = L_S \cdot p_{O_2}^{1/2} \cdot K_3 \quad \dots (4)$$

In this work C_{S2} was determined by equilibrating fluxes with liquid silver which has the advantage of allowing to vary the oxygen potential without affecting C_{S2} as will be experimentally shown. The equilibrium constant K_3 was calculated by using Fukatsu and Kozuka's data⁽²⁾.

2. Experimental procedure: The experiments were carried out in an electric furnace with a mullite reaction tube. Desired oxygen potential was provided by controlling CO, CO₂ and Ar partial pressures. Approximately 4 g of silver and 1.5 g of flux were charged into 16 mmφ nickel crucible. Nickel solubility in silver is around 1% at present experimental temperatures and its influence on f_S , consequently C_{S2} , was not considered.

3. Results: Figure 1 shows the influence of oxygen potential on sulphur partition ($L_S = \text{wt}\% (S) / \text{wt}\% [S]_{Ag}$) at 1200°C. Experimental values of $\partial(\log L_S) / \partial(\log p_{O_2})$ at constant $f_S, \gamma_{CaO}, \gamma_{CaS}$ are fairly close to the value -1/2 which is expected from stoichiometry of desulfurization reaction((1), (3)). Figure 2 shows experimental results of C_{S2} as a function of CaO content at 1200, 1250 and 1300°C for flux compositions at saturation of solid oxides. The general behavior of fluxes can be divided into three regions: (i) 2CaO.SiO₂ saturated fluxes (A to F) have low C_{S2} and are strongly dependent on CaO content; (ii) for 3CaO.SiO₂ saturated fluxes (F to K) the sulfide capacity shows relatively small increase with CaO increment; (iii) for fluxes saturated with CaO up to CaO and CaF₂ double saturation (K to P), C_{S2} is nearly constant, with a small decrease at 1200°C.

REFERENCES

- 1) C.J.B.Fincham and F.D.Richardson: Proc Roy. Soc., A, 223 (1954), 40
- 2) N.Fukatsu and Z.Kozuka: J. Japan Inst. Metals, 45 (1981), 1263

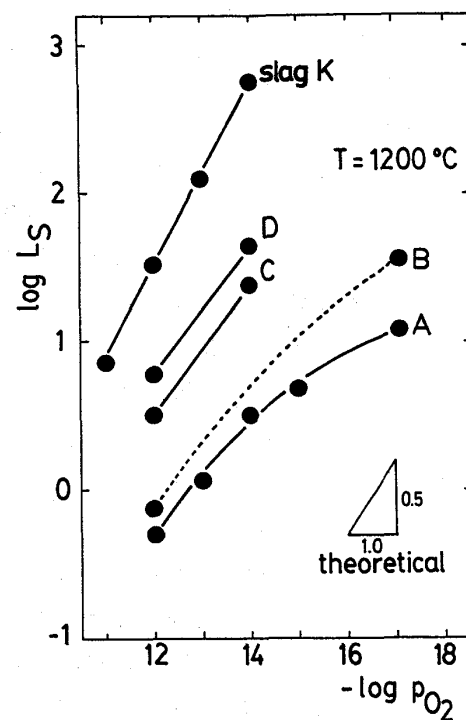


Fig.1 Influence of oxygen potential on sulphur partition between fluxes and liquid silver

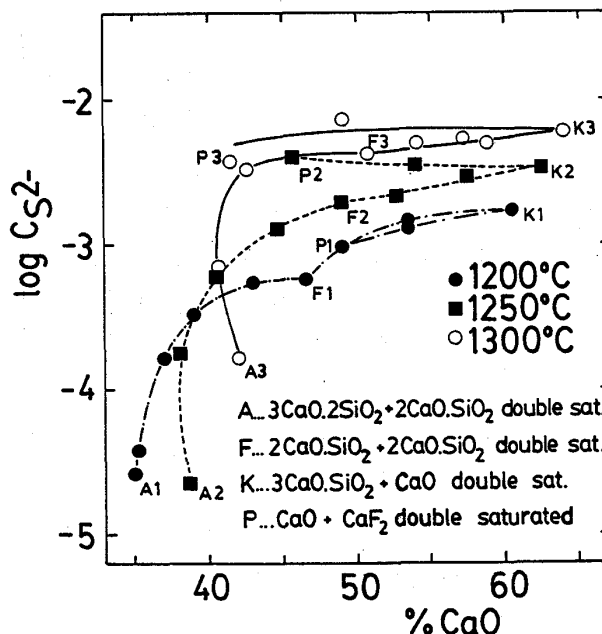


Fig.2 Relationship between sulfide capacity and initial CaO content in the fluxes