(144) Phosphate Capacity of $FeO-Fe_2O_3-CaO-P_2O_5$ and $FeO-Fe_2O_3-CaO-P_2O_5-CaF_2$ Slags by Levitation Melting

Y. SHIROTA*, K. KLEIN**, H-J. ENGELL** and D.JANKE**

* Sumitomo Metal Industries, LTD.
** Max-Planck-Institut Für Eisenforschung.

I. Introduction

The study on the dephosphorization equilbria between molten pure iron and $FeO-Fe_2O_3-CaO-P_2O_5$ slags with and without CaF_2 was carried out using the levitation melting method, at 1600°C, 1650°C and 1700°C.

II. Experimental procedure

The same levitation apparatus and the same slag-metal specimen as Katohgi et al[1] were used.

The molten specimens were levitated for 5 minutes at a given temperature controled by helium gas flow within ±10°C.

III. Results

The dephosphorization reaction can be expressed as Eq.(1) and phosphate capacity is defined as Eq. (2)

$$[P]+5/2(Fe_tO)+3/2(O^{2-}) \rightleftharpoons (PO_4^{3-})+5/2\,tFe(\ell) \quad \cdots\cdots\cdots(1)$$

$$C_{PO_4^{3-}}=2X_{P_2O_5}/([\%P]\cdot(X_{Fe_tO})^{5/2}) \quad \cdots\cdots\cdots(2)$$

where

$$X_{Fe_tO}=X_{FeO}+X_{Fe_2O_3} \quad (X : \text{mole fraction})$$

$$X_{PO_4^{3-}}=2X_{P_2O_5}$$

In Fig. 1 the relation between $\log C_{PO_4^{3-}}$ and $X_{CaO}+X_{CaF_2}$ is shown. Good linear relationships are obtained at each temperature which are formulated by Eq.s(3) and (4).

$$\log C_{PO_4^{3-}}=5.81(X_{CaO})_{eq.}-1.41 \ (1650°C) \quad \cdots\cdots(3)$$

$$\log C_{PO_4^{3-}}=5.04(X_{CaO})_{eq.}-1.19 \ (1700°C) \quad \cdots\cdots(4)$$

where, $(X_{CaO})_{eq.}=X_{CaO}+X_{CaF_2}+0.7X_{MgO}$

In Fig.2, the relationship between $\log C_{PO_4^{3-}}$ and $X_{CaO}+X_{CaF_2}+0.7X_{MgO}$ is shown using, Suito's,[2] Winkler's[3] and Trömel's[4] data at 1600°C. From this result, the linear relationship as expressed by Eq.(5) is obtained

$$\log C_{PO_4^{3-}}=7.70(X_{CaO})eq-1.80 \ (1600°C) \quad \cdots\cdots(5)$$

These relations can be applied for widely different slag systems and wide range of phosphorus content in metal or the phosphorus partion ratio between slag and metal obtained by previous workers

From Eq.s(3),(4) and (5),a general expression for the linear relationship between $\log C_{PO_4^{3-}}$ and $(X_{CaO})_{eq.}$ is derived as Eq. (6).

$$\log C_{PO_4^{3-}}=(75046/T-33.07)\cdot(X_{CaO})_{eq.} -(22558/T)+10.27 \quad \cdots\cdots(6)$$

IV. References

1) Katohgi et al.: to be published, Tetsu-to-Hagané, (1984) vol.70,No.12
2) Suito et al.: Tetsu-to Hagané 67(1981) p2645, 68(1982), p1541.
3) Winkler et al.: Trans. AIME, 167(1946), p111.
4) Trömel et al. : Arch Eisenhütten Wes.,

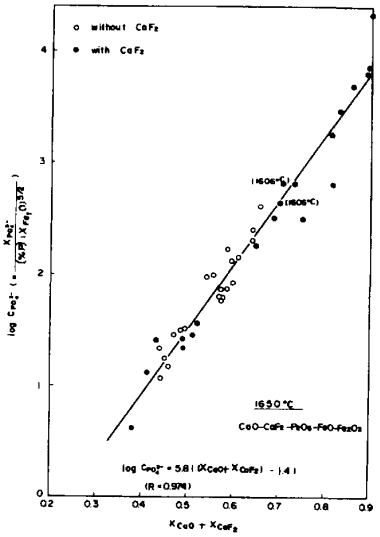

Fig. 1. Relationship between $\log C_{PO_4^{3-}}$ and $X_{CaO}+X_{CaF_2}$

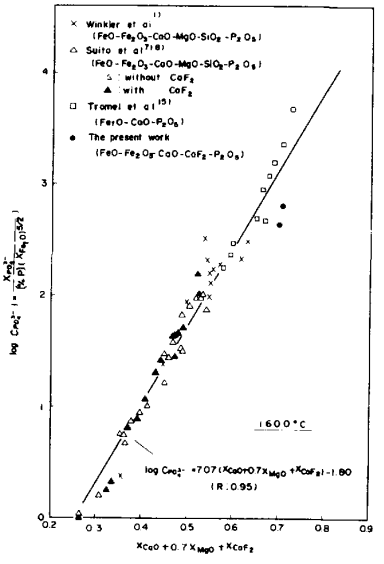

Fig.2. Relationship between $\log C_{PO_4^{3-}}$ and $X_{CaO}+X_{CaF_2}+0.7X_{MgO}$.