(86) Alkali circulating material in the lower part of the blast furnace

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1. Introduction

Numerous papers describe the negative influence of alkali circulating material as swelling and low temperature disintegration[1]. To eliminate as far as possible potassium and sodium from the blast furnace, the lowering of the basicity of the slag is suggested widely.

2. Experiments

The absorption and vaporization of potassium oxide from slags of different composition has been studied. The analyses of the slags were chosen to be similar to the primary slags of a high temperature reduction test for blast furnace burden.

3. Results and discussion

The pick-up of potassium into the slag from the gas phase is shown in Fig.1 as a function of basicity. Experiments were carried out a partial pressure of potassium of $1 \cdot 10^{-3}$ atm.
The vaporization of potassium, which can be described as a change in concentration c_{K_2O} [2]

$$dc/dt = K^x \Delta c$$

increases with rising basicity and temperature as expressed by the constant K^x (Fig.2).
The reason for the greater vaporization is the breaking-up for the network of silicates when the addition of basic components as CaO and the separation of discrete SiO_4^{4-} -complexes[3]. Because of this transformation, the potassium cations which are dissociated from the K_2O-molecule cannot move into the network. Neutraiisation of charge by the potassium cation is not possible due the insertion of the oxygen ion.
The vaporization is greater at higher temperature because of the break-up of the network due to greater thermal energy.
Network forming oxides as Al_2O_3 and TiO_2 can replace the SiO_2 molecule and lower the vaporization rate as shown in Fig.3[4].

4. Conclusion

The vaporization and the absorption behaviour of potassium in slag can be explained by the ionic structure of the slags.
To reduce the accumulation of alkalis the adding of network forming components to the blast furnace slag is necessary.

5. References

1) Wenzel,W.,Gudenau,H.W.,Wee,E.,Mey,K.-P.: Westdeutscher Verlag, Opladen 1979

2) Fukutake, T.,Takeda,Y.,Tsuchiya,N.,Okabe,K.: Australia/Japan Extractive Metallurgy Symposium 1980, Sydney, p. 269/80

3) Frohberg,M.G.: Arch.Eisenhüttenwes. 32(1961)9, p.597/606

4) Stutz,V.: Dr.-Ing.thesis, RWTH Aachen to be published

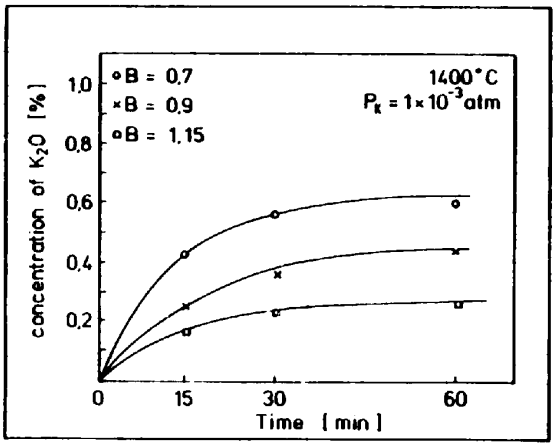

Fig.1: Absorption of K_2O of slags for different basicities

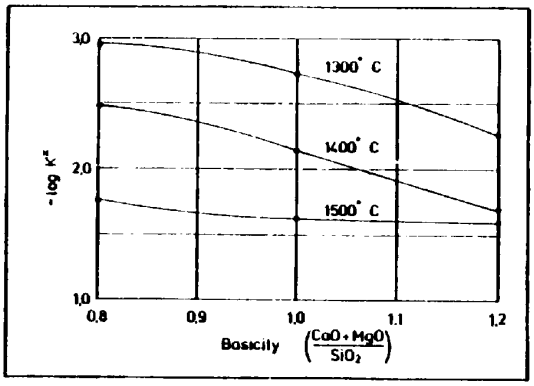

Fig.2: Influence of basicity and temperature on vaporization

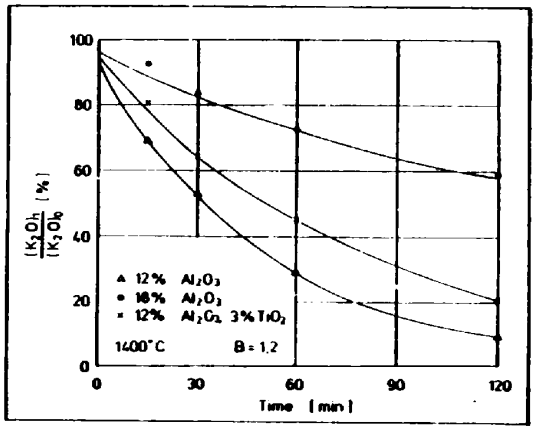

Fig.3: Change in vaporization rate for different additives