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Letter to Editor

EFFECT OF OPTICAL BASICITY ON THE VISCOSITY OF OXIDE SYSTEMS

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Abstract

Viscosity of oxide systems, including slags, can be determined by high temperature experiments, or calculated by chemical / empirical models. Optical basicity is a chemical parameter based on the ionic nature of oxides present. Data on experimentally measured viscosities of some oxide systems, from the open literature, have been used in this study and the optical basicity values have been calculated and subsequently correlated with the viscosity values. Good correlation has been observed between the viscosity and the optical basicity.

1. Introduction

Research work is in progress in NIT, Tiruchirappalli, on metallurgical slags, especially towards prediction of slag viscosities via Oxygen to Silicon ratio and optical basicity. Optical basicity is a chemical parameter, which indicates the tendency of an oxide system / slag to supply oxide ions for chemical reactions. The optical basicity concept is particularly applicable to network systems such as those based on silicates, borates. Duffy and Ingram have determined the optical basicity values for various oxides and have suggested that the optical basicity of an oxide system be determined using the optical basicity values of the constituent oxides (such as $\wedge_A$) and the mole fraction of the oxides[1].

($\wedge = X_A \wedge_A + X_B \wedge_B$)

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2. Results and discusion

Optical basicity for the oxide system was calculated from the chemical composition and then compared with the viscosity reported in the literature[2]. The effect of optical basicity on the viscosity of sodium silicate glasses was analyzed at different temperatures. It was observed that the viscosity of these glasses decreases with increasing optical basicity as shown in Figure 1. Increasing optical basicity may be due to the relatively high theoretical optical basicity value of sodium oxide (1.15). This reveals that the introduction of alkali oxide breaks the silicate network structure and decreases the rigidity, resulting in low viscosity. Trends in sodium borate glasses (Figure 2) also indicate that the viscosity decreases with increasing optical basicity. The work is being continued to look at various oxide systems / slags; and also to look at the relation between structure and viscosity.

3. Conclusions

The optical basicity concept has been extended to oxide systems, glasses and slags. For binary silicate and borate systems, viscosity values steadily decrease with increasing optical basicity and increasing Na-Si / Na-B ratio. It is expected that the optical basicity would be able explain the trends in viscosity and related properties for a wide range of oxide systems.

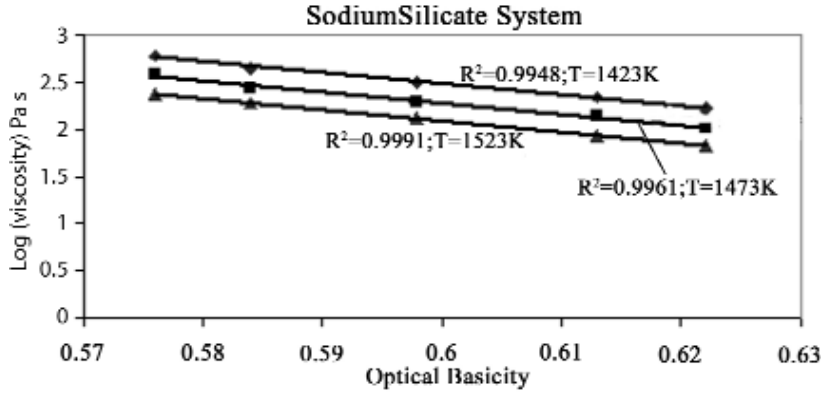

Fig. 1 Effect of Optical Basicity on viscosity of Silicates

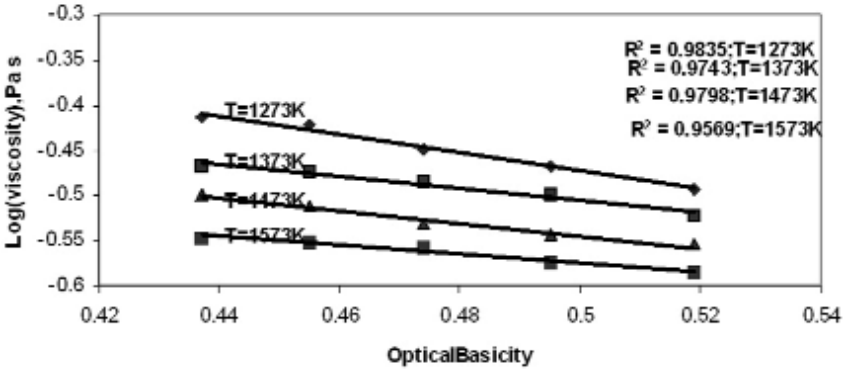

Fig. 2 Effect of Optical basicity on viscosity of borates

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