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Short Communications

A Note on the Connection between Viscosity and Structure in the System CaO-SiO$_2$

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In a recent study of viscosity in the system CaO$-$SiO$_2$ Bockris and Lowe[1] have tried to interpret the anion structure in the region metasilicate-orthosilicate in terms of the variation of the energy of activation with the composition. According to them orthosilicate anions consist of discrete SiO_4^{4-} entities, which are known from X-ray data of solid silicates and at the stoichiometric composition 3CaO·2SiO$_2$ the anions have the composition of $Si_2O_7^{6-}$. As seen from the phase diagram[2] this is not very likely, because this compound melts incongruently. On further addition of SiO$_2$ polymerization should continue, the flow unit being silicate chain ions. But at 50 mole-% CaO an anion $Si_3O_9^{6-}$ should probably be present and represents the meta-anion. This latter form is in agreement with what is found in the mineral wollastonite (CaSiO$_3$) and the results from the determinations of freezing point depression in the system calcium metasilicate-calcium fluoride[3].

It seems probable from the phase diagram of the system CaO$-$SiO$_2$ that not very many types of compounds can exist in the molten state and under no circumstance as many as Bockris and Lowe have concluded. The simplest is to assume that in the part of the system under discussion we only have discrete anions of metasilicate of the composition $Ca_3Si_3O_9$ and orthosilicate Ca_2SiO_4. In Fig. 1 the mole fractions of $Ca_3Si_3O_9$ have been plotted against the viscosities determined by Bockris and Lowe. It is seen that the viscosity is a linear function of $x_{Ca_3Si_3O_9}$. In the ideal case when we have a mixture of two liquids and there is no interaction between them the viscosity is a linear function of the relative composition[4]. It also seems very likely that there will not be any appreciable heat of mixing between two silicates of the same cation. In Table 1 two different sets of equations for the isotherms are recorded, one where the viscosity is a function of the composition and the other

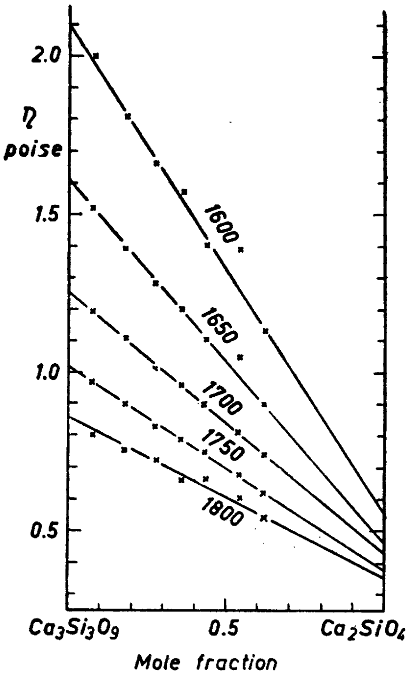

Fig. 1

Table 1.

°C	η	η_{rel}
1 550	$2.18 \cdot x + 0.720$	$3.02 \cdot x + 1$
1 600	$1.55 \cdot x + 0.555$	$2.79 \cdot x + 1$
1 650	$1.20 \cdot x + 0.480$	$2.33 \cdot x + 1$
1 700	$0.83 \cdot x + 0.429$	$1.94 \cdot x + 1$
1 750	$0.62 \cdot x + 0.391$	$1.59 \cdot x + 1$
1 800	$0.46 \cdot x + 0.375$	$1.23 \cdot x + 1$

x= mole fraction of $Ca_3Si_3O_9$.

where the relative viscosity is a function of the composition. In the latter set it is seen that the coefficients of $x_{Ca_3Si_3O_9}$ are smaller for higher temperatures and are a linear function of the temperature (Fig. 2).

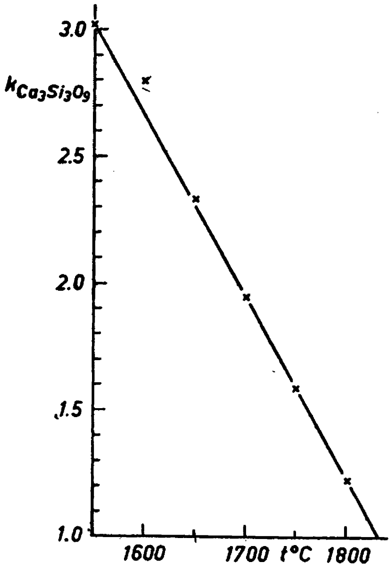

Fig. 2

From the above arguments it can be concluded that very simple relations must exist in the regions of the system under consideration and that it is very probable that essentially only a metasilicate of the composition $Ca_3Si_3O_9$ and an orthosilicate Ca_2SiO_4 exist in the molten state.

1. Bockris, J. O'M. and Lowe, D. C. *Proc. Royal Soc. London* **226 A** (1954) 423.
2. Rankin, G. A. and Wright, F. E. *Am. J. Sci.* 4th Ser. **39** (1915) 5.
3. Bååk, T. and Ölander, A. *Acta Chem. Scand.* **9** (1955) 1350.
4. Frenkel, J. *Kinetic Theory of Liquids*, Oxford 1946, p. 443.

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Isolation of Sialic Acid from Gangliosides

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As far back as 1938 one of us[1] called attention to the close agreement in certain qualitative reactions between gangliosides and a substance some years earlier isolated from bovine submaxillary mucin[2] and later named sialic acid[3]. In 1941 Klenk[3] obtained from the methanolysate of gangliosides the monomethoxy derivative of a split product called neuraminic acid which showed the characteristic colour reactions of sialic acid. In 1952 Blix *et al.*[3] pointed out that the neuraminic acid might have been formed during the isolation procedure by deacetylation of sialic acid, which at that time had been with certainty demonstrated as a component of bovine submaxillary mucin only. The unchanged sialic acid from this material contains one N-acetyl and one very labile O-acetyl[2,3], whereas the neuraminic acid has no acetyl group. The difference in elementary composition between the two substances was reasonably in agreement with a deacetylation. This view was further supported by the isolation of methoxy-neuraminic acid from a methanolysate of submaxillary mucin (Klenk and Lauenstein[6]). Employing a milder procedure Klenk and Faillard[7] later obtained from bovine submaxillary mucin a split product with an elementary composition and an acetyl content corresponding to that calculated for monoacetyl neuraminic acid. This product could by treatment with methanol-HCl be transfor-