(61)　　　Measurement of Silicon Diffusivity in a Molten Fe-Si System

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The incompatibility of diffusion data available has been pointed out by the same authors (1) in their study of manganese diffusivity. Silicon is another important element involved in iron and steelmaking processes, but like manganese, the significant disagreement of reported diffusion constants has prompted a re-consideration. Only one study has been reported on the activation energy of diffusion and concentration dependency of diffusivity up to $N_{Si}=0.3$ (2).

Experimental method, liquid-solid density corrections, liquid-solid diffusivity corrections and quantitative treatment of experimental findings, are essentially the same as those of the previous work (1).

Provisionary findings:

The tendency of the diffusivity constant as a function of concentration at constant temperature generally satisfies the picture predicted by the phenomenological treatment of diffusion phenomena (3). The present finding is generally in good agreement with the only data available for the same purpose (Fig. 1). The following equation may be used in determining silicon diffusivity in the Fe-Si binary system over the concentration range 0-4.4 % Si, within the temperature range 1575-1725°C. (Fig. 2)

$$D_{Si} = 5.1 \times 10^{-4} \exp (- \frac{9,150}{RT}) \text{ cm}^2/\text{sec}$$

図1. 珪素の拡散定数と濃度との関係 (1600℃)

図2. Fe-Si 二元系に於ける拡散定数の温度依存性

References:

(1) F.P. Calderon, N. Sano, Y. Matsushita Tetsu-to-Hagane No.10, Vol 54 Aug. 1968

(2) T. Saito and K. Maruya- Bull. Res. Inst. Min. Dress. and Met. Tohoku Univ. 12(1956)27

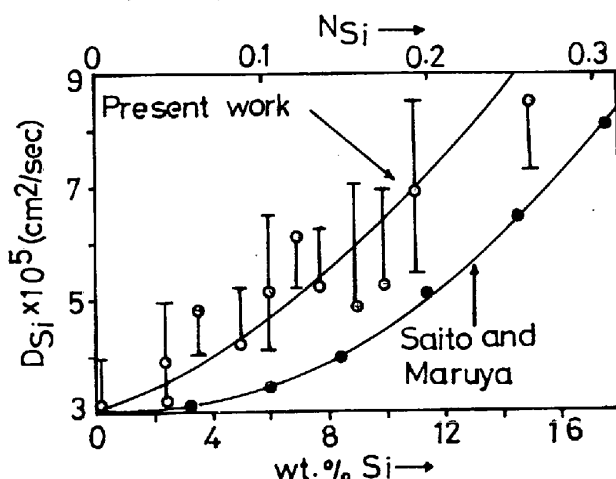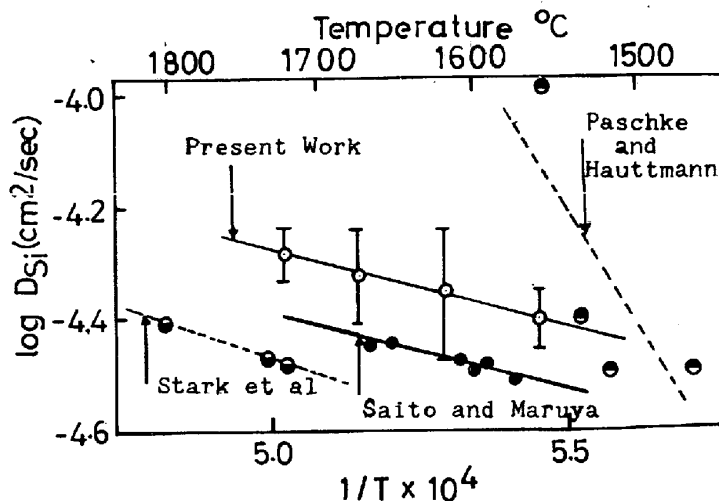(3) L.S. Darken- Trans.Amer.Inst.Min. Met. Engrs. 175(1948)184