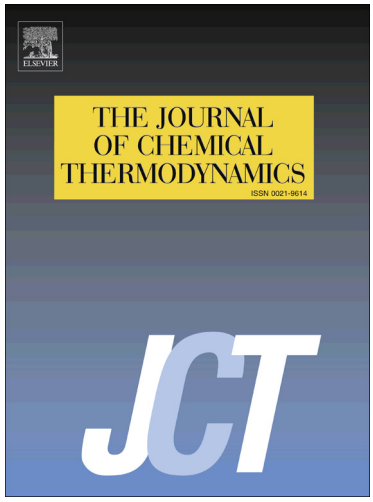

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Experimental determination of diffusion and mass transfer of boron oxide in molten slag for metallurgical grade silicon purification

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Abstract: Mass transfer of boron within silicon and slag is a critical component in boron removal from metallurgical grade silicon by slag refining. To clarify the mechanism of B mass transfer in slag, the present work reports an experimental kinetic study of B removal. The diffusion coefficient of boron oxide in a binary 0.37CaO-0.63SiO_2 (mass fraction) slag was determined by a capillary-bath diffusion device. The mass transfer coefficient of B_2O_3 in the binary slag is calculated according to the experimental observations during slag refining, and the thickness of boundary layer between reaction interface and slag is obtained. The results show that the diffusion coefficient of B_2O_3 in 0.37CaO-0.63SiO_2 slag is 5.24×10^{-9} $m^2\cdot s^{-1}$ at 1723 K; the mass transfer coefficient is 6.2×10^{-6} $m\cdot s^{-1}$ at the same condition. The thickness of the effective boundary layer between silicon-slag reaction interface and slag is 0.85 mm. It is confirmed that the mass transfer of B_2O_3 in binary 0.37CaO-0.63SiO_2 slag is the rate-controlling step for B removal using calcium silicate slag refining.

Keywords: metallurgical grade silicon; slag refining; boron removal; diffusion coefficient; mass transfer; rate-controlling step

1. Introduction

Global fossil fuel reserves are dwindling, which has resulted in increasing

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