Flux smelting behavior of pre-reduced Mn ore by Hydrogen at elevated temperatures

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ABSTRACT

Understanding how ore interacts with flux particles at elevated temperatures to create molten slag is crucial since it governs the dynamics of a chemical reaction. This study explores the smelting behaviour of pre-reduced Nchawaning manganese ore when combined with lime, with the objective of examining the evolving interaction between pre-reduced ore particles and lime over time. The research sheds light on the interaction between solid and liquid and the phases that emerge during this process. To achieve this, a sessile drop furnace was employed to rapidly heat the materials positioned adjacent to each other on an alumina substrate and to observe the smelting process as it unfolded over time. This method allowed for the direct observation of the melting temperatures and the flux-ore reaction progression rate, and the potential disruptive events that might occur. By comparing the molten interfaces of the fluxed materials at various time intervals, this study provides insights into the relative rate of slag formation from the two materials. The results indicate that the main slag formation initiated at approximately 1400 ^{o}C and continued to advance with time, with complete mixing occurring around 1500 ^{o}C. The possible phases formed were identified using Scanning Electron Microscopy and modelled using Fact Sage thermodynamic software. In addition, the iron particles in the pre-reduced Mn ore were separated and settled from a rich MnO-containing slag.