

The Energetics of Hematite Dissolution in Iron Ore Melts for Assimilation in Commercial Sintering Processes: *In Situ* High Temperature Calorimetric Studies

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Melting and crystallization of iron ores in mining applications are determined by the thermodynamic properties of the crystals and liquids in equilibrium. Iron ores are widely used for sinter production in Japan, Korea, Russia, and Australia. In these sinter production plants, multiple ores can be blended together. Sintering is the second stage of a two step process in which iron ores fines, together with coke and flux material are converted into porous blocks of sinter that are suitable for direct feed into the blast furnace. The chemical and physical changes that occur during sintering are formation of granules, melt formation, assimilation and lastly crystallization. The initial stage involves the formation of granules in which small and intermediate sized particles adhere to larger nuclei via water bridging between adjacent particles. The second stage is known as assimilation; which involves the reaction between melt and un-melted iron ore particles during the sintering step. These ores are typically multi-component systems with numerous phases whose variability complicates industrial processing applications. High temperature calorimetry using molten iron-calcium-silicate solvents has been used to better understand and improve the industrial processing of iron ores, and evaluate the dissolution properties of Fe_2O_3 in a series of iron-oxide based melts at 1626 K. In the SFCA (silico-ferrite of calcium and aluminium) oxide mixture, the heat of solution of Fe_2O_3 for the first set of experiments is 52.5 ± 10 kJ/mol as Fe_2O_3 concentration is increased from 59 to 64 mol%. The heat of solution was found to be strongly endothermic and independent of the liquid composition.