Poster Presentation

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In situ observation of reduction reaction of calcium ferrites by XRD and XAFS

R. Murao[1], M. Kimura[1,2]

[1]Nippon steel & Sumitomo Metal Corporation, Materials Characterization Research Lab., Futtsu, Japan, [2]High Energy Accelerator Research Organization, Institute of Materials Structure Science, Tsukuba, Japan

The lime-fluxed iron ore sinter is the major iron source in the steelmaking process. Its macroscopic properties, (e.g. strength, reduction-ability and reduction-disintegration) should strongly depend on characteristics, quantity and morphology of the bonding phase. It contains several calcium ferrite phases (CFs) including solid solutions of gang materials. Most of previous studies focused on the relation of micro-texture with properties of the sinter. However, properties of individual CFs, especially, of multi-component CFs have not been clarified yet. In this study, reduction process and rates of various CFs have been investigated by in situ observation using both X-Ray Absorption Fine Structure (XAFS) and X-Ray Diffraction (XRD) methods to clarify influence of CF species on the properties of the sinter. High temperature XAFS measurements were carried out using a synchrotron radiation source at the 9A beam line in Photon Factory (KEK-PF), Japan. Powdered single phase CFs, such as CaFe2O4, Ca2(Fe,Ca)6(Fe,Al,Si)6O20 (SFCA) were diluted with BN. Fe K and Ca K-edge XAFS spectra at 900 °C and 750°C in He-H2 gas atmosphere were collected repeatedly by the quick-XAFS method. Absorption variations in normalized XANES spectra were used to calculate the reduction rate constants[1]. XRD patterns of various CFs at 900 °C and 750°C were corrected repeatedly at 40-second intervals in N2-H2 gas atmosphere during reduction reaction progressed. Reduction rate of CaFe2O4, determined by XANES analysis was slower than that of Fe2O3. The reduction of Fe in CaFe2O4 was a single first-order reaction, although an induction period was clearly observed at the beginning of the reduction process. In situ XRD observations showed that CaFe2O4 was reduced into Fe and CaO via Fe2+ containing CFs such as CaFe3O5 and CaFe5O7 at 900 °C. These may correspond to the induction period observed in the absorption variation. Analysis results for SFCA will be discussed in the presentation.

[1] *M. Kimura, Y. Uemura, T. Takayama et. al, Journal of Physics: Conference Series 2013, 430, 012074*

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