

REFINEMENT OF IRON ORE SINTER PHASES: A SILICO-FERRITE OF CALCIUM AND ALUMINIUM (SFCA) AND AN AL-FREE SFC, AND THE EFFECT ON PHASE QUANTIFICATION BY X-RAY DIFFRACTION

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Iron ore sinters are produced by adding lime to fine-grained iron ore and reacting these at temperatures of ~1250°C, by propagating a flame through a bed of intimately mixed ore, lime and carbonaceous char. The sinters are the preferred feedstock for the production of iron in blast furnaces and millions of tons are produced worldwide each year. The sintering reaction takes place at the flame front and redox conditions vary from reducing at the flame to oxidizing during cooling.

Silico-ferrite of calcium and aluminium (SFCA) is an important binding phase that imparts improved strength and reducibility to the sinters produced from iron ores containing variable amounts of Fe, Al, Mg, and Si. As a result the SFCA is variable in its composition and variable in its proportions in the sinters.

The amounts of the different phases, mainly hematite, magnetite, SFCA and a dicalcium silicate are contributing factors to a number of important sinter properties such as extent of sintering, tumble index (strength) and reduction index (reducibility) and are also indicators of temperature and redox conditions during sintering. Phase quantification by powder X-ray diffraction methods is therefore an important method for the correlation of the phase quantities with the different indices. Reliable phase quantification using the Rietveld method is dependent on accurate crystal structure data for the constituent phases being available from the literature for all the phases.

It was however found that the calculated diffraction pattern of SFCA using crystal structure data from HAMILTON et al. (1989) and used by the programme Autoquan (KLEEBERG & BERGMANN 2002) differs substantially from the observed pattern of pure synthesized material. Especially, the calculated peaks at low angles are significantly overestimated as compared to the experimental peaks.

To resolve this discrepancy it was decided to re-investigate the structure of SFCA. Also, because of the complex cation distribution of SFCA, containing Fe, Ca, Mg, Al and Si on 15 different cation sites, it was deemed necessary to include also a structure analysis of SFC, which contains only Fe, Ca, and Si, as this would simplify the allocation of cations on the various sites considerably. The present contribution reports the results of these investigations.

HAMILTON, J.G.D., HOSKINS, B.F., MUMME, W.G., BORBIDGE, W.E., MONTAGUE, M.A. (1989): *N. Jb. Miner. Abh.*, 161, 1-26.

KLEEBERG, R., BERGMANN, J. (2002): *Proc. Sec. Int. School on Powder Diffr.*, 63-76.