MITT.ÖSTERR.MINER.GES. 151 (2005)

A PETROGRAPHIC STANDARD FOR DETERMINATION OF IRON ORE REDUCIBILITY IN GAS BASED DIRECT REDUCTION PROCESSES

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Valuable results are provided by a mineralogical and petrographical investigation to determine the suitabiliy of iron ores for the FIOR®, FINMET®, and FINEX® direct reduction process. The iron ore fines used have grain sizes below 12.5 mm and are reduced in fluidized bed autoclaves by gas mixtures of CH_4, CO, H_2, N_2, H_2O, and CO_2 at temperatures between 450°C and 780°C.

The iron ores consist of limonite, hematite, and magnetite of various crystal sizes and variable mineral portions besides of pores and gangue minerals. Hematite usually comprises more than 80 mass% of these iron ores. The specific surface of the ore grains is of paramount importance for the reduction speed in each reduction stage. Limonite is well reducible in any case. Hematite and magnetite are well, moderately, or badly reducible depending on the Effective Crystal Thickness (T_{eff}) and the Effective Oxide Thickness (OT_{eff}). For reducibility determination of an iron ore sample a representative number of crystals and ore grains have to be rated in terms of mineralogical and geometrical parameters with an optical microscope.

The petrographic standard provides qualitative information on degradation and sticking tendency. Semiquantitative information on reduction speed is achieved. With the proposed petrographic investigation the metallisation degree of the final product can be quantitatively predicted in a range of ± 2 % depending on physical and chemical conditions of the reduction procedure.