The variation of sinter strength in the sinter bed due to the mineral phase distribution

by

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It is well known that the quality of sinter is mainly governed by the microstructure and phase composition of the sinter. The phase composition through the sinter bed varies because the sintering conditions are not the same through the sinter bed. Sintering conditions are determined by the temperature-time-characteristics of the sintering process. The aim of this investigation was to investigate the influence that the temperature-time-characteristics of the sinter process may have on the phase formation and sinter quality.

Two series of sinter pot tests were conducted at a different pressure drop over the sinter bed. In the first series the pressure drop was maintained at 1100mmH_2O during the sintering and cooling stage of the sinter process. In order to increase the airflow rate through the sinter bed the pressure drop over the sinter bed was increased to 1500mmH_2O during the second series of sinter pot tests. Data was recorded to determine the temperature profiles in the top, middle and bottom layer of the sinter bed and to determine the temperature-time-characteristics of the sintering process at the different airflow rates.

The sinter cakes produced in each series were divided into three layers to form a top, middle and bottom layer. The physical properties of each layer were quantified with the tumbler test and sieve analyses. A mineralogical study was conducted on each

layer to determine the phase composition. The chemical composition of each phase was determined and the stoichiometry of the relevant phases was calculated.

Because of the different temperature-time-characteristics of the different layers the phase composition and morphology differ in each layer. The longer the sintering time the more hematite is reduced to magnetite. Therefore, the higher magnetite content in the middle and bottom layer. The resulting hematite content correlates with the magnetite content. The higher the magnetite content the lower is the hematite content. A longer sintering time at temperatures higher than 1100°C results in a higher SFCA content. The SFCA content increased from the top layer to the bottom layer. The silica glass content decreased from the top layer to the bottom layer. Linked to these changes in phase content the sinter strength increased from the top layer to the bottom layer.

This project revealed that the sintering time above the temperature of 1100°C is one of the most important parameters to ensure that phases that will enhance sinter quality are formed. The sintering time above 1100°C increased from the top layer to the bottom layer. The sintering time above 1100°C also increased at a lower airflow rate through the sinter bed in series one resulting in a lower magnetite and higher SFCA content and improved sinter quality.

In spite of the correlation found between the sinter strength and phase composition of the sinter in this investigation, it became clear that the phases are not the only parameter determining the sinter strength. The morphology of the sinter phases present, porosity of the sinter and coke rate may have an influence on the sinter quality and should be investigated.

Key words:
Sinter, sinter bed, phase composition, microstructure, physical properties, temperature profile

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