Geometallurgical Characterization of a Channel Iron Deposit (CID) Ore

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ABSTRACT

Channel iron deposits (CID), comprising pisolite ores or goethitic ores, remain a prominent iron ore resource in Western Australia. Previous research work on CID pointed out their complexity in genesis, geology, geomorphology, and petrology, which provides some basic information for downstream processing. Sintering investigations have mainly focused on the overall sintering performance and the quality of sinter products rather than behaviour during sintering. However, individual mineral phases in the ores have their own characteristics during reaction with fluxing materials in the sintering process. In this study, the complex mineral phases in a CID goethitic ore are compared with traditional hematite ores. They are classified into several categories based on the mineral composition, including basic mineral phases goethite matrix, hydro-hematite, and quartz, and combined minerals quartz-dispersed hydro-hematite, quartz-dispersed goethite, goethite with dispersing quartz and clay (gibbsite/kaolinite), and ferruginised wood. The behaviour of the goethitic ore when heated to different temperatures was also investigated. More cracks appeared in the ore with increasing temperature due to dehydration of the ore matrix. The temperature induced goethite-to-hematite transformation occurred between 260 °C and 300 °C, as shown in TGA-DSC curves and confirmed by XRD analysis. The color of the goethitic ore changed from brown to vermillion after 300°C due to the phase transformation, and then turned ochreous at 1150°C and further turned black above 1250°C from the decomposition of hematite to magnetite.

Keywords: Channel iron deposits, goethitic ore, minerals, characterization, classification.