

Beneficiation of Low Grade Chromite Ore and Its Characterization for the Formation of Magnesia-Chromite Refractory by Economically Viable Process

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Abstract : Chromite ores are primarily used for extraction of chromium, which is an expensive metal. For low grade chromite ores (containing less than 40% Cr₂O₃), the chromium extraction is not usually economically viable. India possesses huge quantities of low grade chromite reserves. This deposit can be utilized after proper physical beneficiation. Magnetic separation techniques may be useful after reduction for the beneficiation of low grade chromite ore. The sample collected from the sukinda mines is characterized by XRD which shows predominant phases like maghemite, chromite, silica, magnesia and alumina. The raw ore is crushed and ground to below 75 micrometer size. The microstructure of the ore shows that the chromite grains surrounded by a silicate matrix and porosity observed the exposed side of the chromite ore. However, this ore may be utilized in refractory applications. Chromite ores contain Cr₂O₃, FeO, Al₂O₃ and other oxides like Fe-Cr, Mg-Cr have a high tendency to form spinel compounds, which usually show high refractoriness. Initially, the low grade chromite ore (containing 34.8% Cr₂O₃) was reduced at 1200 °C for 80 minutes with 30% coke fines by weight, before being subjected to magnetic separation. The reduction by coke leads to conversion of higher state of iron oxides converted to lower state of iron oxides. The pre-reduced samples are then characterized by XRD. The magnetically inert mass was then reacted with 20% MgO by weight at 1450 °C for 2 hours. The resultant product was then tested for various refractoriness parameters like apparent porosity, slag resistance etc. The results were satisfactory, indicating that the resultant spinel compounds are suitable for refractory applications for elevated temperature processes.

Keywords : apparent porosity, beneficiation, low-grade chromite, refractory, spinel compounds, slag resistance

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