

Beneficiation Strategies for Removal of Silica and Alumina from Low-Grade Iron Ores

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ABSTRACT

Silica and alumina are major impurities in iron ores, and as higher-grade ores become depleted, there will be a greater focus on developing suitable beneficiation strategies to treat low-grade ores containing higher levels of impurities. Separation of impurities from iron oxides such as hematite and magnetite is known to be extremely difficult due to their mineral association properties and the processing applicable to reduce impurity levels will depend on the mineralogy of the lower-grade iron ores and a thorough understanding of the process dynamics associated with the separation technology.

Existing beneficiation approaches to upgrading low-grade ores typically use a variety of concentrating methods to obtain products of acceptable grade and iron recovery. The major concentrating methods that may be applied to upgrade lower-grade lump iron ores include magnetic separations, wet and dry heavy media separations and air pulsed jigging. Technologies applicable to beneficiating iron ore fines include wet and dry gravity and magnetic separations, flotation and roasting processes followed by a magnetic separation.

The performance of different separation technologies, their testing methodologies and the challenges and difficulties involved in the removal of silica and alumina from low-grade iron ores are reviewed. It is necessary to investigate the application of separation technologies on a case-by-case basis to select economically viable beneficiation strategies suitable for the particular low-grade iron ore. A commercial flowsheet is expected to involve the implementation of several separation technologies. This will allow an informed selection and testing of possible process options for iron ore beneficiation and have the potential to reduce the operational complexity of circuits thereby generating savings in capital and maintenance costs.