

## PROCESS MINERALOGY STUDIES OF LOW GRADE IRON ORES USED IN THE PRODUCTION OF PELLET FEED

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### Abstract

The growth of iron ore production has led mining companies to expand their reserves by improving the technological knowledge of their mineral resources. Moreover, the exhaustion of high grade iron ores (from friable to compact), which usually require only a correct size adjustment, stimulates the study of lower grade iron ores such as banded iron formations (BIF) with high SiO<sub>2</sub> grades. Brazilian iron ores have mostly demonstrated different degrees of weathering, which results in significant modifications in the mineralogical composition, especially regarding the content of goethite and clay minerals.

This study was conducted on three samples of low grade Brazilian iron ores with distinct degrees of weathering and complex mineralogy, targeted for the production of pellet feed. The aim was the assessment of the liberation of iron oxides and their associations to the gangue minerals, especially silica, aluminum and phosphorus bearing minerals.

The experimental procedure involved homogenization and sampling, grinding below 0.21 mm in a rod mill, wet sieving and desliming, heavy liquid and magnetic separations, chemical analyses by XRF, mineralogical composition by X-ray diffraction (XRD), SEM-EDS analyses to assess the chemical composition of mineral phases and image analysis conducted by MLA system to evaluate the mineralogical composition, mineral liberation and associations of iron oxides.

The results clearly demonstrate that the Fe grades and the liberation of the minerals of interest are directly correlated to the alteration degree of the samples. The content of iron oxides increases from 29% to 61% for samples with a higher weathering degree; the goethite content and its association to hematite-magnetite interfere in the liberation degree of these minerals, specially on free surface, while it was also confirmed that goethite is mainly present at the borders of the particles due to the weathering process.

Despite the low Fe grades achieved in magnetic products of Samples A and B, due to the presence of paramagnetic grunerite that showed similar behavior to the iron oxides in the magnetic separations, the image analyses indicate the possibility of attaining products with Fe grades higher than 65% and potential recoveries of around 80 to 85% for the minerals of interest, similar to those attained in Sample C.

Using this approach, the characterization studies proved to be important in predicting metallurgical recovery related to the ore mineral processing and in identifying factors that may interfere with the quality of the final product.

**Keywords:** low grade iron ore, process mineralogy, automated image analysis

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