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Microwave treatment of a hot mill sludge from the steel industry: *en route* to recycling an industrial waste

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ABSTRACT

Oily hot rolling mill (HRM) sludge containing a high percentage of iron oxides has been treated under microwave irradiation, and the products compared to hexane washed and thermal treated sludges. Metals present in the sludge act as a highly microwave-absorbent material, creating hot spots that trigger the stripping of the water and oils under air. The sludge loses 5 wt.% of water and volatiles under 5 min of microwave irradiation (1000 W at 2,450 MHz), which represents a similar reduction in weight as 4 h heating at 200 °C, but with savings in energy and time. Most importantly, after microwave irradiation, the material also shows an improvement in its rheological properties (free flowing and smaller particle size) and changes in its chemical composition. Microwaved samples are less oxidized than heated ones (lower Fe³⁺ content), which is an advantage recycling the sludge as a source of iron with lower oxidation state necessitates a lower coke:ore ratio for blast furnace operation.

Highlights

- Oily hot rolling mill (HRM) sludge treated with microwave radiation.
- Water and hydrocarbon content reduced by microwave treatment.
- Reduction of the iron oxidation state of the iron oxides after microwave treatment.

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