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REDUCTION OF NICKEL LATERITE ORE BY NADUONG COAL

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Combination of reduction - magnetic separation is one of the methods considered more effective for separating nickel from laterite nickel ores. Recent studies showed that sulfur or its compounds have the effect of forming weak magnetic iron sulfides during the reduction process, thereby

limiting iron from entering magnetic products (concentrates containing Ni). Sulfur also increases nickel recovery efficiency in the magnetic separation stage by increasing the size of ferronickel particles formed during the reduction stage.



The studies were conducted with tailings samples from chromite ore mine in Mau Lam area, Thanh Hoa. The tailings from the chromite ore beneficiation process is a nickel-containing laterite ore, the nickel content in the samples is of 1.179 % Ni

Samples of Naduong coal and Vangdanh anthracite are used in these experiments.

Na Duong coal sample used in the experiment contains up to 7.66 %S. This amount of sulfur is considered to have a positive effect on the reduction process.







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Results of the reduction with additives T-1050°C; Coal: 10%; Na ₂SO₄: 3%

| Coal type | % Ni in Magnetic product | Recovery (%) |
|-----------|--------------------------|-----------------|
| Na Duong | 3.16 | 65.87 |
| Vang Danh | 3.55 | 68.35 |

The analysis results also found particles with main components of Fe and S in the reduced product. Although there is no specific analysis of the form present, it can be confirmed that sulfur in the coal has participated in the formation of iron sulfides.

Compared to Vang Danh coal, the use of Na Duong coal allows obtaining concentrate products with a similar nickel recovery rate, but higher nickel content.

The additive Na_2SO_4 has significantly improved the reduction process. Compared to using only coal, the addition of 3 % Na_2SO_4 during the reduction process increased the nickel content in the magnetic concentrate from 2.88% to over 3.16%, the recovery rate reached over 65 %.

Experiment procedure flowsheet



Results of the SEM-EDS analysis of the sample after reduction at 1100 °C

Research results have showed the prospect of using Na Duong coal, a type of high sulfurcontaining coal, as a reducing agent in the reduction-magnetic separation process to recover nickel in low-content nickel laterite ores. However, more research is needed on other technological parameters such as reduction time, additive mixing ratio, size reduction parameters, etc. to be able to provide a flowsheet and technological regime when applying Na Duong coal in the actual production.