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A NOVEL METHOD FOR IMPROVEMENT OF QUALITY OF A MAGNETITE CONCENTRATE

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Insufficient quality of magnetite concentrates is a common problem in many Ukrainian beneficiation plants. Low-intensity drum magnetic separators that are employed at all stages of the process, including the final enrichment stage, are not suitable for improvement of the grade of the concentrate.

The reason is a high intensity of the magnetic field, usually exceeding 100 kA/m (0.13 T), generated by the drum separators. This magnetic field induces magnetic flocculation of the magnetite particles, which results in entrapment of quartz particles in the flocs.

A new technique for enhancement of the grade of the concentrate has been proposed [1]. It is based on the flow of slurry along the walls of vertical ferromagnetic plates placed in a magnetic field. Intensity of the magnetic field increases in the direction of the flow from almost zero in the upper section of a plate to about 25 kA/m (0.03 T) or less in the lower part. Such a magnetic field is too weak to induce magnetic

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TABLE Enhancement of the grade of magnetite concentrates

Samples from Poltava Mining	*Feed into the final stage (% Fe)*	*Grade of concentrate (% Fe)*		*Grade of non-mags (% Fe)*
		Existing circuit	*Novel method*	
Formation K22	66.3	67.1	68.8–69.1	14–16
Formation K23	63.6	64.7	65.7	17.6

flocculation. The magnetic force that is needed to attract the magnetite particles to the plates is achieved by generating a high gradient of the magnetic field. By reducing the rate of magnetic flocculation the quartz and locked magnetite/quartz particles are released and removed from the concentrate.

The method has been tested on laboratory scale and the results are summarised in the Table. It can be seen that the grade of the formation K22 of the Poltava Mining concentrate was increased by about 2 per cent, while that of the formation K23 concentrate of the same benefication plant by 1.0 per cent. The ore of the last formation is difficult to treat.

This method can be used for the concentration of liberated magnetite particles into final concentrate from each stage of the circuit. In what follows an example of such a treatment of magnetic middlings (Fe = 45,9%) of the first stage of separation in the Central Benefication Plant, Krivoy Rog. Fine particles, smaller than 0.063 mm, were extracted from this sample. After the separation of these fine particles in the field of a low magnetic gradient, the magnetic fraction thus obtained was separated using our method. As a result, the magnetic product, the iron content of which is 68,9%, was obtained. This product can be regarded as the final concentrate. Its mass yield is 32.6%. The iron content of the non-magnetic product is 34.5%. This product is subjected to further treatment in the next stage of the flowsheet.

References

[1] Turkenich, A. M. (2000). A method of wet magnetic separation of fine magnetite ores and a device for its implementation. *Ukrainian Patent Application No. 2000031221.*

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A CONTINUOUS BARRIER MAGNETIC SEPARATOR FOR THE TREATMENT OF WEAKLY MAGNETIC ORES

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A serious disadvantage of induced electromagnetic roll separators used for beneficiation of weakly magnetic ores is the need for frequent maintenance of drives and bearings. In addition, power consumption of the roll drives used in the Ukraine and Russia is often greater than that of the magnetic circuits of these separators, as is shown in Table I. Rare-earth permanent magnetic roll separators and drum separators suffer from similar drawbacks.

These disadvantages are absent in continuous barrier magnetic separators. A material to be separated is fed into a zone of separation (matrix) and magnetic and non-magnetic fractions are discharged from the matrix continuously. The separator does not have any moving parts. It is thus not necessary to maintain the drives and bearings and it is possible to reduce the power input by 30 to 50 per cent.

The first barrier magnetic separator was patented by Frantz in 1936 [1]. New inventions in this field were subsequently filed in the USA

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