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# *Recent Dissertations*

## HIGH–INTENSITY AND HIGH–GRADIENT MAGNETIC SEPARATION IN MINERAL PROCESSING

J.A. JIRESTIG
University of Technology, Luleå, Sweden
Doctoral Thesis No. 147D (1994), 212 pp., 43 refs.

The thesis tests and proves the use of magnetic separation for non–ferrous minerals and also extensively studies the underlying magnetic properties of minerals. An increased understanding of HGMS and WHIMS was obtained by studying particle capture in a matrix. Several non–ferrous minerals were shown to have sufficient magnetic susceptibility to be captured in a magnetic separator. However, the magnetic properties of minerals are not uniform but depend to a large extent on impurities. Small amounts (less than 1%) of ferromagnetic inclusions can significantly change the bulk susceptibility of a weakly magnetic material. It follows, therefore, that each mineral in an ore displays a magnetic susceptibility distribution. The shape of the occurrence curve determines whether magnetic separation is a viable process or not.

## WET MAGNETIC CONCENTRATION FOR WEAKLY MAGNETIC MINERAL FINES AND ULTRAFINES

Y. WANG
University of Technology, Luleå, Sweden
Doctoral Thesis No. 130 D (1993), 196 pp, 75 refs.

The study aimed to reveal the characteristic magnetic behaviour of natural weakly magnetic minerals (such as hematite and chromite) and the size limits of the particles recoverable by existing modern high intensity and high gradient magnetic separators. It also aimed to enhance the particle aggregation and/or magnetic response for wet magnetic concentration of the ultrafines that escaped from the separators. It was found that hematite and chromite exhibited variations in magnetic behaviour with respect to magnetising field, temperature and particle size. High gradient magnetic separation with industrial matrices was shown to be efficient for weakly magnetic minerals as small as 10 $\mu$m. but below this size separation efficiency was poor. Modifications were made to existing magnetic technology and alternative methods were investigated for the efficient recovery of particles smaller than 10 $\mu$m. These included the "carrier" or "piggy–back" method, aggregation with magnetic bonding and hydrophobic magnetite seeding. It was shown that wet magnetic separation was efficient for ultrafine fractions whereas other methods could be used to increase effective particle size dimensions and/or magnetic susceptibilities.

## THE DETERMINATION OF PARAMETERS OF AN INERTIAL–MAGNETIC SEPARATOR FOR BENEFICIATION OF FINELY GRAINED ORES OF RARE AND PRECIOUS METALS

S.A. KRAVTSOV
Moscow State Mining University, Moscow, Russia
PhD. Thesis (1995), 160 pp, 21 figures, 11 tables, 40 refs., 2 appendices (42 pp)

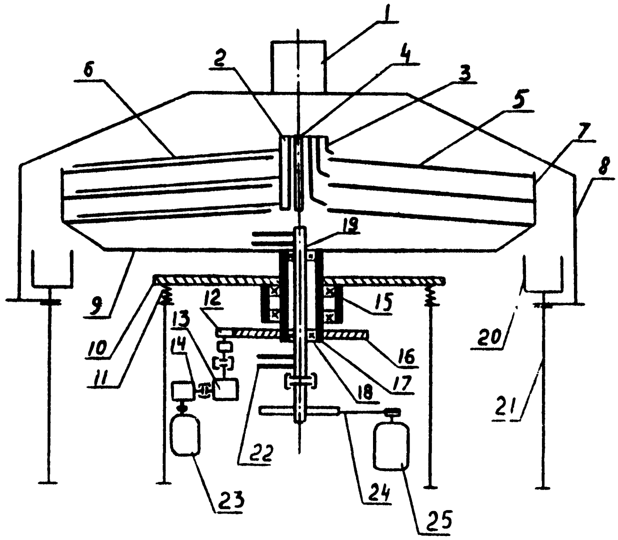
Supervisor: Professor V.V. Karmazin

This thesis describes a new inertial–magnetic separator designed to reduce losses of valuable components during the beneficiation of finely grained ores of rare and precious metals. The proposed method concerns the magnetic drag during the beneficiation of weakly magnetic particles of minerals from the ores of rare and precious metals on an inclined plane. This plane performs orbital oscillations by employing a separation surface made of a magnetic resin with a low–intensity magnetic field and high gradient. The efficiency of beneficiation can thus be increased by 10 to 12%.

An equation describing relationship between the characteristics of magnetisation of the magnetic resin and the parameters of magnetisation in a pulse magnetic field was derived. A computational technique that was also developed allows to determine the required parameters of an inductor which guarantees basic characteristics of the surface magnetisation of the magnetic resin.

Behaviour of the velocity distribution of the fluid flow on an inclined conical surface of the separator allows to determine the flow velocity at any point. The velocity of transport of particles in the fluid flow of small thickness, along an inclined surface of the magnetic resin is determined by a relationship based on the Richards formula. This relationship takes into account a force acting on particles by the separating surface, depending on magnetic properties of the particles.

Based on theoretical and experimental investigations, criteria of separability of a mixture of mineral particles, under the influence of orbital oscillations, permit to determine the maximum recovery of a given mineral into a given heavy fraction after a full separation of a mixture. Optimum parameters of magnetisation of the magnetic resin for the beneficiation of weakly magnetic ores, with low concentration of the recoverable minerals, were determined. The intensity of the magnetic field on a pole is equal to 42 kA/m (530 Oe), the step of the poles is 4 mm.




Schematic diagram of the inertial–magnetic separator
1–Slurry distributor, 2–the concentrate wash water, 3–slurry feeder, 4–rinse water, 5–discs, 6–blades, 7–dowels, 8–the feeder frame, 9–supporting disc, 10–platform, 11–shock absorbers, 12–drive gear, 13, 14–reducers, 15–bearings of the hollow shaft, 16–driven gear, 17–hollow shaft, 18–bearings of disbalance, 20–the product tank, 21–supports, 22–disbalances, 23–motor of the rotation gear, 24–v–belt transmission, 25–motor of the vibration gear