*Magnetic and Electrical Separation*, Vol. 10, pp. 259–262
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# EQUIPMENT AND PRODUCTS

## NEW IMPROVED RARE-EARTH MAGNETS

Sumitomo Special Metals Co. Ltd. is producing two new rare-earth permanent magnets that have improved magnetic properties, one of which is claimed to be the world's strongest permanent magnet. This new magnet grade is known as Neomax 50 and has the magnetic energy product of 400 kJ/m$^3$. The other product, Neomax 48BH, features a high resistance to the magnetic loss at high temperatures, exhibiting a maximum coercive force of 875 kA/m. Both new materials use Nd, Sm and other rare earth elements, along with improved crystal grain orientation. Total production of both new magnetic materials is about 10 t per month.

## NON-CORROSIVE Ni-PLATED MAGNETS

Nd-Fe-B resin bonded magnets need to be coated in order to prevent corrosion. Polymer coatings are often used because traditional electroplating techniques are inadequate. Sumitomo has introduced a new dry plating process that coats plastic magnets with metallic nickel. The coating improves durability and control of coating thickness and reduces static build-up of dust particles.

## A NEW HITACHI BONDED MAGNET

Hitachi Ltd. has developed an 8 MGOe bonded magnet based on Sm-Fe-N. The Sm-Fe-N material is reported to have enhanced corrosion resistance over Nd-Fe-B and a temperature coefficient half that

of Nd-Fe-B. Hitachi expects to be able to achieve 10 MGOe soon. Sample shipments were scheduled to begin in March, 1999, and the company projects sales of US$4.2 M in 2000.

## CRYOFREE® OGMS FROM OXFORD INSTRUMENTS

Oxford instruments have manufactured two Cryofree Open Gradient Magnetic Separation systems for industrial dry separation of minerals. Both magnets were supplied to Carpco Inc., now a member of Outokumpu Group. A Cryofree system does not require cooldown with liquid nitrogen and helium. Instead, two 4 K cryocoolers are used to cool the magnet and its high-temperature superconductors current leads. The OGMS magnet produces a magnetic field gradient of at least 250 $T^2$/m on the outside surface of the vacuum casing. The field gradient is present in a zone 200 mm long by 20 mm high. Rigid support for the magnet inside the casing enables it to be inclined, preventing the particle stream from hitting it. Cryofree magnets for academic research have recently included a 9 T solenoid with an integral 30 K variable temperature insert and a 7 T split pair.

## THE FIRST LARGE-SCALE HTS MAGNET

A high-temperature superconducting (HTS) magnet has been installed in the beam line of an accelerator in New Zealand. This is the first large-scale permanent installation of HTS technology world-wide. The magnet consists of two HTS racetrack coils made from $Bi_2Sr_2Ca_2Cu_3O_{10}$. The magnet generates a large volume uniform field of 0.72 T. The 100 A coils are designed to operate at 50 K and are conduction-cooled using a single-stage cryocooler.

## A RARE-EARTH DRUM SEPARATOR FROM CARPCO

MagForce rare-earth drum magnetic separators from Carpco are reported to be used in separation of various industrial minerals, such as garnet, ilmenite and glass sand. The separator employs Nd-Fe-B

permanent magnets aligned in a patented position and the field strength of 9 kG (0.9 T) is reported to be obtained on the surface of the drum. Comparison with a rare-earth permanent magnetic roll separator indicates that both separators perform equally well at low throughputs (*e.g.*, 2.5 t/m/h). However, at high feedrates (*e.g.*, 7.5 t/m/h) the recovery of garnet dropped by 13 per cent for the roll separator, while for the drum separator the recovery decreased by 1 per cent only.

## MAGNETIC FIELD VIEWING FILM

Magne-rite Inc., New York, USA, offer a flexible film that allows the user to visually determine the static magnetic field of hard and soft permanent magnets, as well as magnetic field generated by electric current. The basis of the film is micro-encapsulation of colloidal nickel, which gives the paper-thin plastic film its flexible nature.

## THE STRONGEST MAGNET TO-DATE

A sintered Nd-Fe-B permanent magnet that has been developed by Sumitomo Special Metals, Osaka, Japan, is claimed to feature a world record maximum energy product of 55.8 MGOe (444 kJ/m$^3$). The residual magnetic flux density was measured to be 15.14 kG, 95% of the theoretical maximum flux density for this intermetallic compound phase. The magnetic properties of the new magnet were gained by a combination of reducing the non-magnetic phase of the grain boundaries, increasing the polycrystalline orientation to approximately 98% alignment and density to 99%.

Home page: http://www.ssmc.co.jp

## NEW HIGH-TEMPERATURE PERMANENT MAGNET MATERIAL

A new sintered high-temperature rare earth permanent magnet materials have been developed by the University of Dayton, USA. Currently the best existing high-temperature permanent magnets can

operate up to 300°C. The problem for a higher temperature operation has been that the intrinsic coercivity of these magnets drops sharply upon heating. For example, $H_c$ of the best conventional Sm-Co magnets drops from 20 – 30 kOe at room temperature to only 2 – 6 kOe at 400°C. The intrinsic coercivity of the new Sm-Co magnets reached 13 kOe (2 to 6 times higher than the current materials).