

Magnetic separation evolution with Eriez

In the 40 years that **IM** has been spreading the non-metallic minerals gospel, *Paul Fears*, marketing director, Eriez Magnetics Europe Ltd, explains how magnetic separation technology has changed beyond recognition

IN 1967, ERIEZ Manufacturing Co. in the USA had already been in existence for 25 years, with the founder, Orange Fowler "O.F." Merwin, championing the benefits of utilising magnetic forces for separation. Only one year later, in 1968, the European operation was conceived, closing their first order in April of that year.

Today, Eriez is a global company with headquarters in Erie, Pennsylvania and eight manufacturing affiliates ensuring a presence in every major geographical market.

O.F. Merwin's grandson, Richard Merwin, is the present chairman of Eriez, which is still privately-held. Since the early 1990s Eriez has grown significantly, with countless new developments and acquisitions including Boxmag Rapid (magnetic separators) and Prisecter (Sampling).

Magnetic separator evolution

In 1967, there were essentially only two types of magnetic separator depending on how the magnetic field was produced; this either being with charged ceramic ferrite or alnico permanent magnets or with an electromagnetic coil.

Generally, when processing non-metallic minerals, high magnetic fields are required and this was only possible using electromagnets. For dry processing this meant using an Induced Roll Magnetic Separator (IMR) where the magnetic field produced by the coil was induced into a steel roll. Magnetic particles became attracted to the magnetised roll and were then separated from the non magnetic material.

Rare earth & WHIMS

In the mid-1980s a new stronger permanent magnet material became commercially available that dramatically changed the world of magnetic separation: samarium-cobalt. The magnetic intensity of systems such as magnetic drums increased dramatically. By the mid-1990s, there were further advances

in magnetic separation technology using neodymium-iron-boron rare earth magnet, which was jointly developed by General Motors, Sumitomo Special Metals, and the Chinese Academy of Sciences.

These advances in magnet material strength resulted in the development of the Rare Earth Roll Separator, especially for processing dry non-metallic minerals such as silica sands and feldspar. The permanent magnet Rare Earth Roll Separator essentially replacing the power consuming electromagnetic IMR, using discs of rare earth magnets sandwiched between steel pole pieces.

Today, the preferred roll separator option is 300mm diameter when the first were 75mm and 100mm. Furthermore, the energy product of the magnet material and thus the ability to produce higher magnetic fields has gradually increased.

One of the most common magnetic separation systems in the world is the Wet High Intensity Magnetic Separator (WHIMS). This technology was first commercially applied in the early 1960s and is still used extensively for the beneficiation of iron ore and minerals where there is a high iron content.

Until the early 1990s, the WHIMS was the only technology available for many non-metallic mineral producers. However, it was often not possible to achieve a specific separation objective.

In the early 1990s, Eriez embarked on developing the High Intensity (HI) Magnetic Filter for the ceramic and mineral industry with the aim of achieving the more stringent quality requirements and reaching lower iron levels. The HI Filter was also lower in cost, cleaner and considerably easier to install and operate.

The first laboratory tests demonstrated its superiority over WHIMS. Today, the HI Filter is used extensively throughout Europe for processing non-metallic minerals such as silica sand, feldspar, kaolin and in some cases replacing flotation.

Superconducting magnets

Most non-metallic mineral slurries only need a maximum background field of 6,500 Gauss to meet their separation target.

For many fine mineral slurries, such as kaolin and calcium carbonate, higher magnetic fields are required and it is only possible to produce such fields using superconducting technology.

The world's first industrial superconducting magnet for mineral processing was built by Eriez and installed at Huber in 1986 to process clay. This was an extraordinary breakthrough in terms of magnetic separation. There have been enormous advances in superconducting technology and, at the end of the 1990s, Eriez developed the world's first industrial cryogen-free superconducting magnet for mineral processing.

The cryogen-free, superconducting POWERFLUX HGMS is very similar in operation to the HI Filter, with material passing up through a centrally located matrix. The background field is nominally 1.5 Tesla produced by a coil that is not cooled by expensive liquid cryogenics such as helium.

This technological leap forward suddenly means that more companies can apply superconducting magnet technology and consequently produce higher quality materials or upgrade lower quality raw materials.

Mag-sep's future

As the world's resources diminish and environmental issues grow, there is a growing need for better and cleaner separation techniques. Magnetic separation is often simple to operate and inexpensive. The way forward is a combination of processing techniques and higher magnetic fields.

However, technologies such as superconducting continue to advance at an incredible speed, opening up new opportunities for Eriez to further enhance their extensive range of separators. Nobody knows what the next 40 years will bring, but one thing is sure, it will be exciting and Eriez will be at the forefront.