Tips:

Understanding how rare-earth magnetic materials can help you remove iron contaminants

There are different grades of rare-earth magnetic materials, and which grade is right for your magnetic separator depends on many factors. This tip includes information on rare-earth magnetic materials and how to work with a supplier to select a separator that provides the magnetic strength and service life you need.

A rare-earth magnetic separator can be the solution you're looking for if you need to remove very fine iron particles, weakly magnetic iron particles, or paramagnetic particles from your product. Rare-earth magnetic materials, which are stronger than conventional alnico and ceramic magnetic materials, are especially suited to removing such contaminants.

These contaminants can come from several sources. For instance, a screw conveyor whose flights rub against the metal housing's bottom can contaminate your product with very fine iron particles. Rust, a weakly magnetic iron contaminant, can be swept off a chute wall by product flow. An example of paramagnetic particles — nonmagnetic particles that become feebly magnetic through work hardening — can be stainless steel particles that fall off equipment and bump along a steel chute's surface.

Like other magnetic materials, rare-earth materials can be used in several types of separation equipment, including tubes, grates, plates, radial field cartridges, drums, and rolls. This range of configurations means you can find a separator that installs easily into your process line.[1]

Understanding magnetic material grades

The metals used in rare-earth magnetic materials are *lanthanides*. They range from atomic number 57 to 71 on the periodic table of elements and include lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium. The metals are blended with other elements to form various magnetic compounds.

Rare-earth magnetic materials are available in several grades, based on their magnetic energy product (measured in mega-Gauss oersted [MGOe]), temperature ranges, and corrosion resistance. For instance, a moderate-grade samarium-cobalt compound has moderate magnetic strength but can withstand very high temperatures without a permanent loss of strength. A high-grade neodymium-iron-boron compound has higher magnetic strength but is more sensitive to high temperatures. Higher grades are typically more costly, too.

For help understanding the various grades, you can refer to the *Magnetic Materials Producers Association Standard 0100-96: Standard Specifications for Permanent Magnetic Materials*.[2] Be aware, however, that development of new rare-earth magnetic material grades is outpacing the standard's development. For instance, the latest edition lists rare-earth neodymium-iron-boron materials up through only a 44-MGOe energy level, yet such materials are currently available in the 45- to 48-MGOe range.

Adding to the confusion, each magnetic material producer offers a range of grades that can be similar but not identical to another producer's range. And the producers continuously improve their magnetic materials.

But you don't need to become a magnet expert to cut through the confusion and select a rare-earth magnetic separator that's equipped with the right magnetic material grade for your application. Instead, work with a well-known magnetic separator supplier. The supplier receives magnetic materials from an established producer and will run tests using your product to ensure a given magnetic material removes your contaminants and can provide a long service life under your operating conditions.

Testing your product in the supplier's lab

Before testing your product, the supplier will ask you to complete a test data sheet. You'll need to supply information about your product, including its chemical composition (in percentages), mineral or mineral-compound content (in percentage by weight), particle size distribution, bulk density, moisture content, and special handling precautions (if any); how the product is presently pro-

cessed, fed, conveyed, and separated in your plant; the amount of magnetic contaminant in the product (estimated in parts per million); and your processing capacity (in tons per hour).

The lab staff may ask for additional information, such as your process's operating temperature and the process equipment layout. Tests typically require about 30 pounds of representative product, which you should submit with a Material Safety Data Sheet. If you prefer, you can observe the tests at the supplier's lab.

Before the tests, the lab staff will choose one (or more) rare-earth magnetic material grade and separator type for your product based on your test data sheet information and their experience with similar applications. Then, duplicating your feedrate and operating conditions, the staff will run your product through the magnetic separator. Finally, they'll analyze the end product to determine how much of the contaminant has been removed.

The test results will indicate how well the rare-earth material grade and separator type meet your purity requirements. A member of the lab staff can also visit your plant to determine the best location for the separator and provide installation advice. Often a magnetic separator can be installed in your plant on a trial basis (called an *in-plant test*) to test its performance for a longer period under variable plant conditions.

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References

1. Find more information on magnetic separators in articles listed under "Metal detection/separation" (page 112) in *Powder and Bulk Engineering*'s comprehensive "Index to articles," December 1996.

2. Available from Magnetic Materials Producers Association, 8 South Michigan Avenue, Suite 1000, Chicago, IL 60603; 312/456-5590.