Rare earths: a looming crisis for motion controls?

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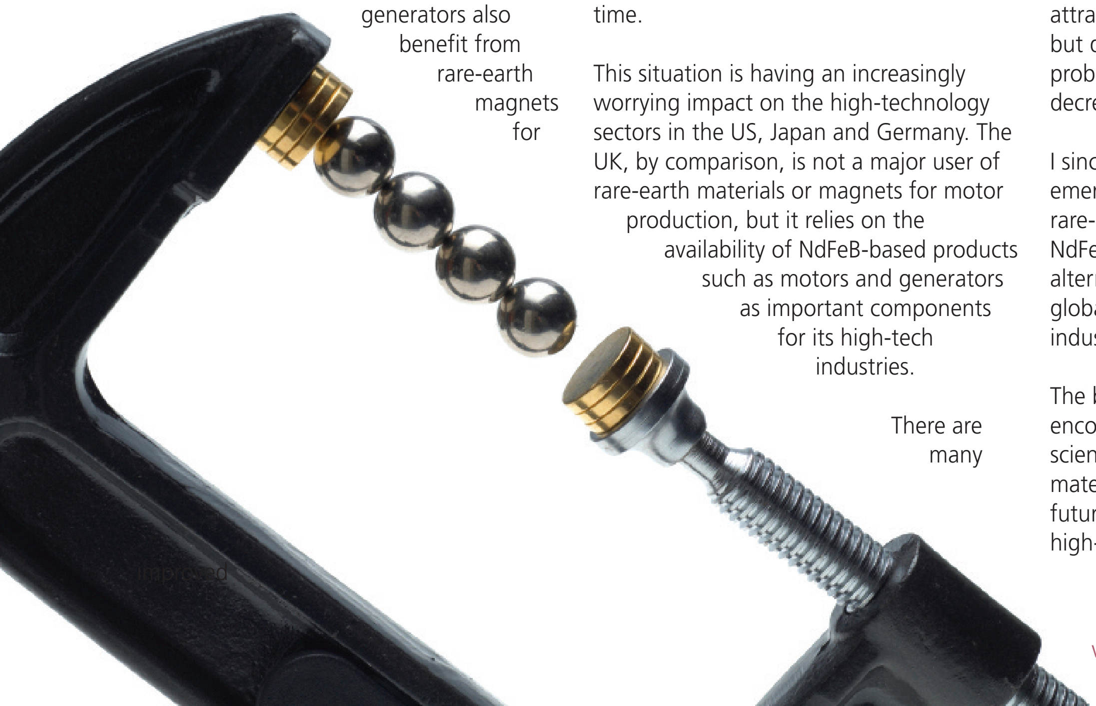
Motion control engineers appreciate the considerable advances in motor performance that have been achieved in recent decades by the commercialisation and mass manufacturing of rare-earth magnet systems. Rare-earth-based magnetic materials – particularly those using neodymium iron boride (NdFeB) – offer a marked increase in dynamic performance over ferrite magnets for motor torque and acceleration. These materials also contribute to improved motor efficiency and to the ability to use smaller motors to do a job. At present, there are no motor technologies that can rival the performance of NdFeB for most applications.

Neodymium rare-earth magnets are now used widely in linear and rotary, brushed and brushless servomotors, as well as in stepper motors in automated positioning systems. They are also used in specialist areas such as cordless tools and computer hard drives. Wind turbine generators also benefit from rare-earth magnets for performance and efficiency. And electric vehicles, which are an almost predestined requirement for our future transportation, will also benefit greatly from NdFeB materials.



Less than 15 years ago, 90% of the world's rare-earth magnet production was in the US, Europe or Japan. However, China started to develop its rare-earth industry with major investments, while the other countries allowed their grip on the industry to loosen. China's emerging producers began to offer extremely competitive prices for rare-earth materials and derivatives such as magnets, causing the industrialised producers to fall away or to lose interest.

Recently, however, it has become increasingly expensive to buy rare-earth materials and magnets from China, with prices increasing substantially each year. At the same time, China is reducing its exports of rare-earth materials though, for now, not the derivative products that use them – but that may be just a matter of time.

This situation is having an increasingly worrying impact on the high-technology sectors in the US, Japan and Germany. The UK, by comparison, is not a major user of rare-earth materials or magnets for motor production, but it relies on the availability of NdFeB-based products such as motors and generators as important components for its high-tech industries.

There are many reports on this predicament which cover the wider situation, extending to the potential dearth of other rare-earth materials that are critical for high-technology areas from lasers and fibre optics, to metal alloys, batteries and MRI scanners.

In January this year, the Parliamentary Office for Science and Technology published an excellent briefing on the current state of affairs (www.parliament.uk/post). The report concludes with potential solutions, including mining initiatives in the US and Australia, that will begin to redress the global availability of rare-earth materials from 2014.

However, the report does not give specifics on new alternative magnet manufacturing sources outside of China, except to mention that Japan is developing alternatives to NdFeB. At present, however, there is no material that can surpass its performance. The report also discusses recycling of materials, which is apparently attractive for high-power magnet systems, but does not seem to solve the potential problems of escalating costs and decreasing availability.

I sincerely hope that an initiative will emerge outside of China to process raw rare-earth neodymium materials into NdFeB or will develop new high-power alternatives to safeguard the future for the global motion control and motor-related industries.

The big question is whether sufficient encouragement is being given to the scientific community to develop alternative materials to ensure our nation's role in future advancements, and to maintain a high-tech economy?