Japan and Vietnam join forces to exploit rare-earth elements

Short supplies of the metals used in high-tech applications prompt countries to establish joint research centre.

Ichiko Fuyuno

13 July 2012

In an effort to overcome China's near-monopoly on the supply of rare-earth elements, Japan and Vietnam have launched a joint research centre in Hanoi to improve extraction and processing of the materials.

Rare-earth elements include scandium, yttrium and the 15 lanthanides found towards the bottom of the periodic table. Their unique optical and magnetic properties are used in various high-tech applications, such as motors, catalysts, light-emitting diodes and batteries.

Most of the elements are actually more abundant in Earth's crust than precious metals such as gold or platinum, but the properties of the 17 rare-earth elements are so similar to each other that extracting and purifying them requires sophisticated processes. Many of these technologies were originally developed in the United States, but "China now has the most experienced and abundant technical expertise because they have been doing the majority of work in this area for 20 to 30 years", says Corby Anderson, a metallurgical engineer at the Colorado School of Mines in Golden.

A report by the US government's Congressional Research Service estimated that in 2010, China had 55 million tonnes of rare-earth element reserves, about half of the world's total, but that it produced about 98% of the total global supply.

In recent years, China has set limits on its exports of rare-earth elements, driving up global prices and forcing other countries to invest in exploiting their own resources so that they can supply their high-tech industries. "Japan is the second-largest consumer of rare-earth products after China, but it could catch up in a few years if the Japanese government gives proper backing," says Yasushi Watanabe, an expert in mineral processing engineering at the National Institute of Advanced Industrial Science and Technology (AIST) in Tsukuba, Japan.

Stringer Shanghai/Reuters

Mining of rare-earth elements is dominated by China, which produces 98% of the world's supply of these metals.

Concentration challenge

The Rare Earth Research and Technology Transfer Centre was officially opened in Hanoi on 16 June, kitted out with 420 million yen (US$5.3 million) of equipment. The centre has yet to launch any research activities, but it is already testing its mineral roasters and mixer-settlers to extract rare-earth elements from minerals. At the new centre, several Japanese researchers will collaborate with scientists from Vietnam's Institute for Technology of Radioactive and Rare Elements, also based in Hanoi.

"Properties of minerals differ between mines, so we aim to establish the optimal methods to produce high-quality rare-earth products," says Yoshiaki Igarashi, chief representative of the Hanoi office of the Japan Oil, Gas and Metals National Corporation, which oversees the new centre.

Japanese companies are already mining rare-earth mineral deposits in Kazakhstan, India and Australia, as well as in Vietnam. But "the [Japanese] government's involvement in rare-earth research in Vietnam reflects a rapidly growing sense of crisis in Japan" that the island nation will face a serious supply crunch, says Watanabe. Specific details of research at the centre are still under wraps, but work will involve establishing core technologies to separate and concentrate the prized elements, he adds.

All at sea

Japan has also launched numerous government-funded projects to develop technologies for recycling rare-earth elements from used high-tech components, and to find other materials that could be used as substitutes.

Meanwhile, researchers at the University of Tokyo reported at a conference in Tokyo in June that they have discovered seafloor sediments in Japanese waters that contain an estimated 6.8 million tonnes of rare-earth elements. And on 4 July, India's science

minister Ashwani Kumar announced that the country planned to mine rare-earth minerals from the sea bed of the Central Indian Ocean Basin, using up to four specially commissioned ships.

But Anderson cautions that such deep-sea mining may be extremely costly and complicated. “There are hundreds of defined rare-earth minerals and mineral deposits around the globe. The important point is to find deposits that can be economically developed.”

Nature | doi:10.1038/nature.2012.11009