



Heavy rare earth prices take off

July 2011

Eu and Dy prices surge three-fold in June as China continued its clampdown on mining operations in the southern provinces. End users take measures to counter cost impact

Heavy rare earth prices soared to new highs in June as China continued its clampdown on mining operations in the southern provinces.

Export prices for europium and dysprosium oxides more than tripled in three weeks and market sources expect further increases in the third quarter.

Heavy rare earth producers, largely based in the south-eastern province of Jiangxi, have been slowing production as the Chinese government carries out inspections to enforce environmental and safety standards.

"The central government has come down hard on provincial authorities to make sure they are enforcing everything, forcing companies to slow down production," a major exporter of Chinese rare earths told **IM** when this issue went to press.

"Prices will keep going up as, over the next couple of weeks, the government is really going to enforce the environmental practices it promised. They are visiting every factory," the source added.

The export price of europium oxide (99%, FOB China), used as a red phosphor in televisions and fluorescent lamps, was in late June between \$3,400/kg and \$5,400/kg, up from a range of \$1,260-1,300/kg at the start of the month.

Dysprosium oxide, a key component of high-strength rare earth magnets, rose to a range of \$1,470-2,400/kg from \$700-740/kg.

At the same time, prices for the heavy rare earths gadolinium oxide and ytterbium oxide rose to \$350/kg and \$300/kg respectively (delivered, USA), which according to one buyer was "quite a bit higher than expected".

"I think they are more man-made prices than supply and demand," said the exporter. "The government is really cracking down on us. If it is not a representative export price, we are forced to change it."

Heavy rare earths production is especially sensitive to China's latest measures, as the industry is made up of many scattered small mining operations, while illegal production and smuggling are widespread.

China plans to merge its southern rare earth assets into as few as three companies to increase its control over production and exports.

Fears of shortages for rare earths such as europium, terbium and dysprosium have become more pronounced as, for the first time, prices *within* China are also rising fast.

One Chinese source said the quoted price of ion adsorption clay - the Jiangxi-sourced ore used to process heavy rare earths - rose by renminbi (Rmb) 100,000/tonne, or 17%, in one day during mid-June.

"Maybe they've shut down more production than even their internal markets can deal with, creating a shortage inside the country, giving the export prices another bump," a US rare earth buyer speculated.

The *Wall Street Journal* reported in June that China also plans to establish a strategic stockpile of heavy rare earths, which would further constrain exports.

A rare earth producer told **IM**: "Many actions [by the Chinese government] will reduce availability inside China for these materials."

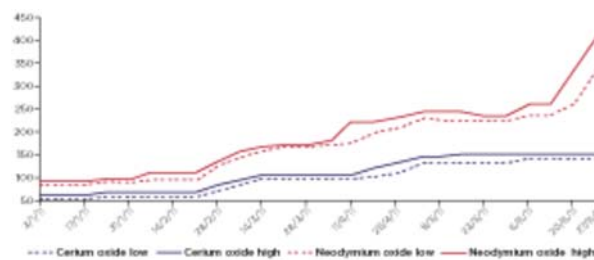
"In my view, the anticipated short supply to meet expected demand is now filtering down to the heavy rare earths, in particular europium and dysprosium."

Light rare earths stabilise

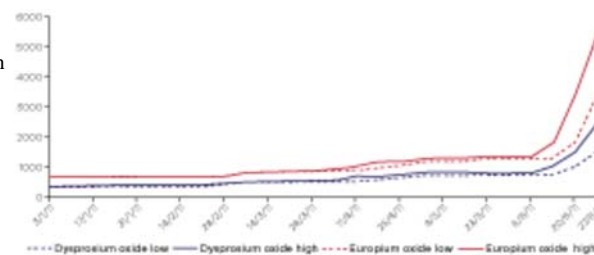
In contrast to europium and dysprosium, prices of lower-value light rare earths largely stabilised in May and June after record gains since the start of the year.



Selected light rare earth prices (99%, FOB China, \$/kg)



Selected heavy rare earth prices (99%, FOB China, \$/kg)



Prices for light rare earths, such as cerium and lanthanum, were the first to skyrocket early this year after China announced its reduction in export quotas for the first half of 2011, while heavy oxides were subject to slighter increases.

A US consumer of rare earths commented: "Chinese exporters want to use their quotas on the highest priced material to make the best use of them. But the pressure has been put on because there is such a shortage in the world."

"I don't really know where the end is going to be. I thought prices would level off once the market adjusted to what was going to be exported from China," added the source.

Light rare earths are largely mined in the northern region of Inner Mongolia, where the Chinese government has consolidated operations under one entity, Baotou Iron and Steel Group, the world's biggest rare earth producer.

The two lightest oxides, lanthanum and cerium, peaked at a high end of \$150/kg in mid-May and were in June trading at respective ranges of \$140-149/kg and \$140-151/kg.

But neodymium oxide, a key rare earth use in high-strength magnets, bucked the trend. Export prices rose to \$330-400/kg from \$235-258/kg at the beginning of June.

Neodymium-iron-boron (NdFeB) magnets - used in hard disk drives and wind turbine motors - are a significant driver of demand growth for both neodymium and dysprosium.

"The outlook for memory storage is still very strong. So there is still a good demand for NdFeB magnets and the prices are going to continue upwards," said the rare earth exporter.

Demand for NdFeB magnets also takes a seasonal upturn in the second quarter as hard disks are produced ahead of the Christmas season for hi-tech products such as games consoles, laptops, MP3 players and smart phones.

Light rare earth prices will be significantly impacted by China's rare earth export quota for the second half of 2011, expected to be announced in July.

For the first half of 2011, China reduced quotas by 35% to 14,446 tonnes, down from 22,282 tonnes in H1 2010.

That decision followed a drastic year-on-year cut of 72% in the second half of 2010, which set off the initial upwards trend of rare earth prices after years of relative stability.

End users hike prices, find substitutes, recycle

Rising prices have forced end users to take emergency measures to counter out-of-control raw material bills.

Companies buying rare earths have reacted by passing through higher prices to customers, developing 'low rare earth' products, finding substitute materials, recycling, or even investing in new rare earth projects outside of China.

As one buyer put it: "The prices are just crazy... they are making me try to get by with as little [rare earths] as possible. If prices continue to go up, our customers will want to find alternatives."

Japan's Shin-Etsu Chemical Co. announced that it will be increasing the price of rare earth magnets by over 40%, both overseas and in Japan from 1 July.

Contracts will now be priced monthly, the group said, and will be based on raw material pricing.

"The recent prices of neodymium and dysprosium are increasing at an abnormal pace of three times in a two-month period, and the existing price-revision period became no longer in accordance with the actual situation," the group outlined in a statement.

Rising prices are also having a significant impact on the production of catalysts used in oil refineries to extract petroleum products, according to US producer WR Grace & Co.

Fluid catalytic cracking (FCC) catalysts are the main end market for lanthanum oxide, the lightest of the rare earths, which has increased in price by almost 20-fold in the last year.

Grace has responded by developing new FCC catalysts and additives with zero or low rare earth content to mitigate the effects of the ongoing supply squeeze.

"In the 1980s and 1990s, most FCC catalysts had zero rare earths to maximise gasoline octane. In the face of severe rare earth shortages, we could produce catalysts without rare-earth stabilisation," said Abrams.

"However, refiners could anticipate increased makeup rates in that scenario and the world could face a shortage of capacity for FCC catalysts," he told IM.

Meanwhile, French rare earth processor Rhodia and battery materials group Umicore have developed a technology for recycling rare earths from rechargeable batteries.

Umicore will extract rare earth elements from standard nickel metal hydride (NiMH) batteries at its battery recycling plant in Antwerp, Belgium, which can be refined into new rare earth materials at Rhodia's La Rochelle processing plant in France.

"This is the first industrial process that closes the loop of the rare earths contained in NiMH batteries," said Sybolt Brouwer, Umicore's general manager for battery and recycling development.

A typical NiMH battery, which includes standard rechargeable AA and AAA batteries, is made up of 7% rare earths, including the light elements cerium, lanthanum, neodymium and praseodymium.

Rhodia said this equates to one gram of rare earths for a AAA battery, 60 grams for a household power tool and two kilograms for a hybrid electric vehicle (HEV) battery.

To put this into perspective, prices for the cheapest rare earth oxides - cerium and lanthanum - are trading at about \$140-150/kg, so potentially up to \$300 of rare earths could be recovered from one HEV battery or 2,000 AAA batteries.

While many in the market assume rare earth supply will remain tight until new mines start to come on stream, China has given no hint at what its second half exports quota will be.

This quota announcement, expected in July, remains the single largest factor affecting prices in the near term.

See p.48 for a review of the rare earth market and China's continuing influence on it.