Making Sense out of all this "Rare Earth" stuff

It seems to be very confusing to make sense out of all that we have been hearing about the "shortage of rare earth elements" and the "spike in rare earth metals prices." What is a rare earth element and why is it so important to us?

What is a "Rare Earth"?

The name "Rare Earth Metals" or "Rare Earth Elements" commonly refers to seventeen chemical elements in the periodic table, specifically the fifteen lanthanoids plus scandium and yttrium. These elements, once relegated to the dingy test labs of a few bi-spectacled scientists, are now used in manufacturing a wide variety of industrial products such as magnets, lasers, batteries, high refractive index glass, fluorescent lamps, and catalyst for oil refineries.

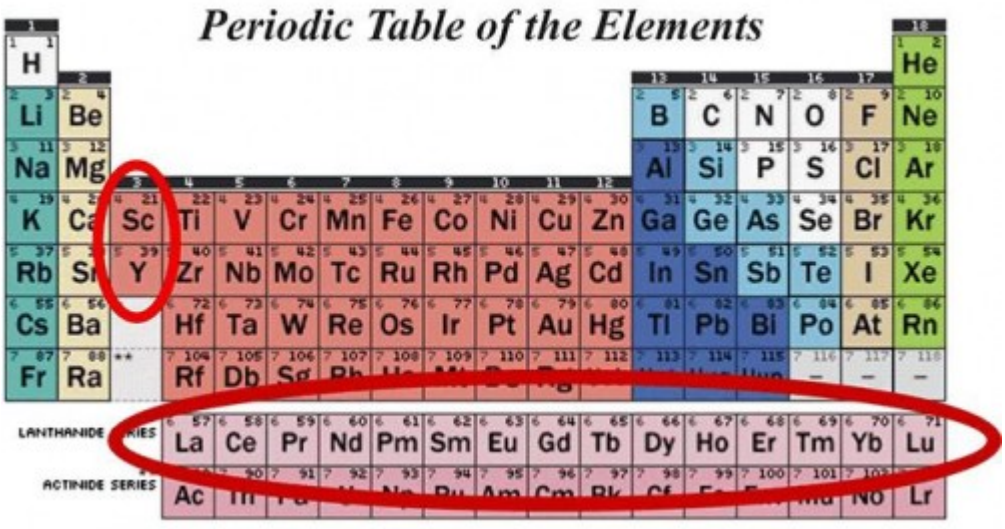

Figure 1 "Rare Earth" metals are a group of 15 chemically similar elements (grouped separately in the periodic table) known as lanthanides along with scandium and yttrium, both of which are actually elements above lanthanum in the periodic table.

Gadolinite, a silicate mineral, which consists principally of the silicates of cerium, lanthanum, neodymium, yttrium, beryllium, and iron, was the first rare earth mineral to be discovered in 1787, at a quarry in the village of Ytterby, Sweden. Over the next 150 years, the world has come to know of all the present day rare earth metals through a series of discoveries.

"Rare Earths" are an essential element in the phosphors used in the fluorescent lamps and light-emitting diodes (LEDs). Europium is the first of the rare earths used because it glows red when hit with an electron beam. Europium also makes a blue phosphor. And the third rare earth metal is called terbium. It is used to make a green-glowing phosphor. All three colors are used individually in LEDs and in combination to create differing color temperatures in high quality tri-phosphor 800 and 900 series fluorescent tubes.

97% of Rare Earth Elements comes from China

Until September 2010, most people had never even heard of rare earth elements or rare earth metals. There are some major misconceptions in the market.

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1. First, the name “Rare Earth Elements” is a misnomer as most of these elements exist in abundance. The truth is that these elements exist in abundance in the earth’s crust.

2. The second misconception is that these elements are available only in China. Nothing could be further than the truth. The difficulty is that they are mostly found in combination with one another and the separation of individual elements into a pure form is very costly. Due to cheap labor in China, Western-world mines simply could not compete.

Until 1948 most of the world’s “Rare Earth” supply came from sand deposits in Brazil and India. But in the 1950s, South Africa became the primary source, with U.S. supplies ramping up and continuing well into the late 1980’s. And while there is still some residual production from those sources, China has stepped to the front of the pack. Its “Rare Earth” metal production dwarfs everyone else. China is now responsible for nearly 97% of the world’s “Rare Earth” production.

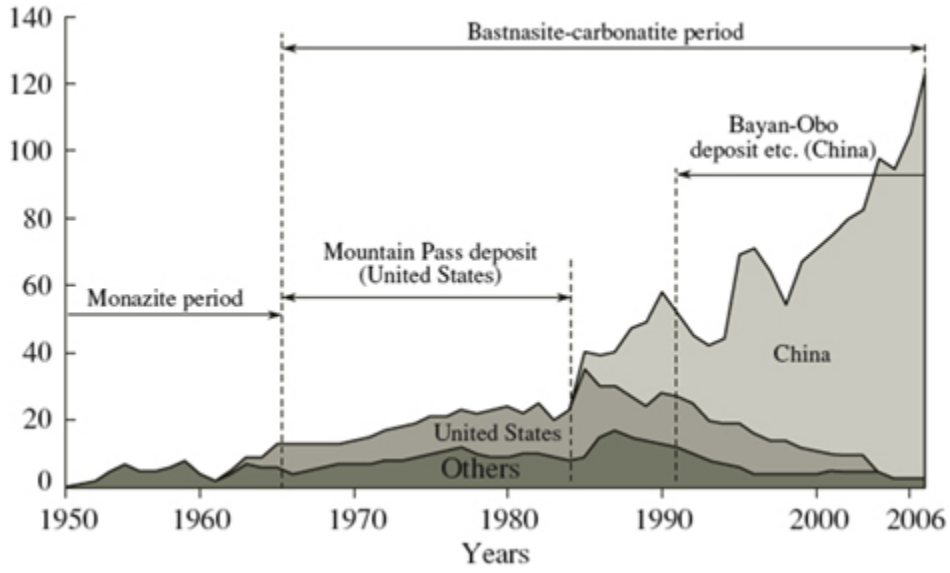

Figure 2 Rare earth production was dominated by the U.S. mine in Mountain Pass, Calif., from 1965 to 1984, when the Chinese began production, subsequently driving other mines out of business by underpricing them (source: U.S. Geological Survey).

So what’s the worry?

Over the past 10 to 15 years, “Rare Earth” metal usage has increased dramatically, resulting in a significant strain on supplies. In fact, there’s growing concern that the world may soon face a shortage that could rise to over 40,000 tons annually.

The range of applications for which they are used is extraordinarily wide, from the everyday items like automotive catalysts and petroleum cracking catalysts, flints for lighters, pigments for glass and ceramics and compounds for polishing glass, to the highly specialized products such as miniature nuclear batteries, lasers repeaters, superconductors and miniature magnets.

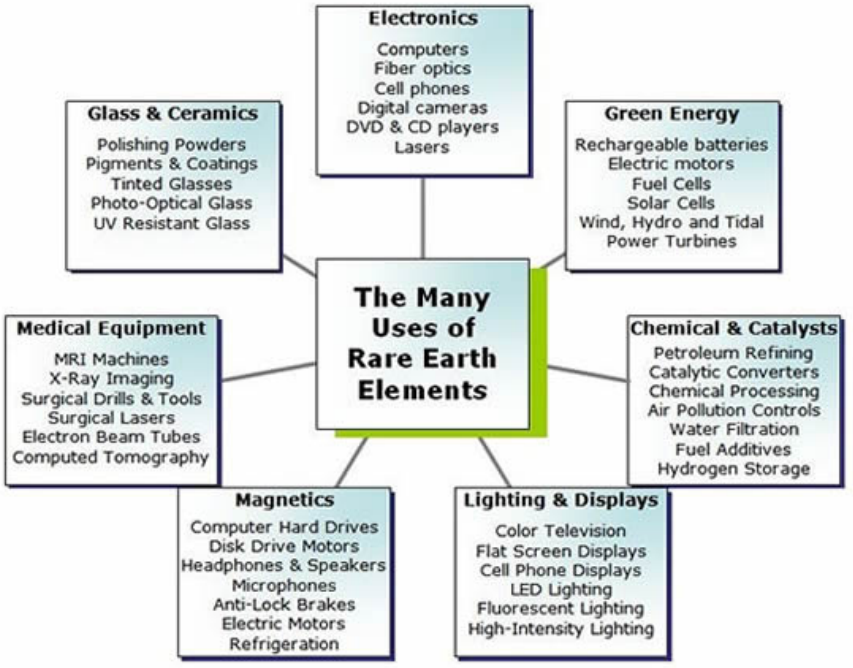

Figure 3 Some say the world runs on oil. One might now argue that the world runs on these "Rare Earth" metals.

To understand how prevalent the use of rare earth metals has become, we need to look no further than the smart phone craze. The iphone for example, is powered by a permanent magnet made with the rare earth metal neodymium. The screen and display module on the iphone are manufactured with europium, yttrium and terbium and the lens in the camera has a coating of lanthanum.

The use of “Rare Earth” metals isn’t restricted to smart phones. They are in TV screens, computer hard drives and anti-lock brake systems. They are baked into aircraft engines and instrument systems, MRI and X-ray machines, and they are used in modern oil refining and water purification systems. Within a few years, “Rare Earth” metals such as europium, yttrium and terbium will be in almost every light bulb.

“Rare Earth” metals are now especially important as they are already incorporated into many parts of the defense industry. Some of their specific defense applications include: anti-missile defense, aircraft parts, communications systems, electronic countermeasures, jet engines, rockets, underwater mine detection, missile guidance systems and space-based satellite power.

China uses most of what it produces so it is naturally going to want to protect its own interests. The country is stockpiling its supplies and continuing to reduce annual exports of “Rare Earths.” The real concern is that within a few years China may decide to keep everything it produces.

As a result of this threat from China, there is now a worldwide flurry of “Rare Earth” exploration. Australia is currently developing the richest “Rare Earth” deposits outside of China.

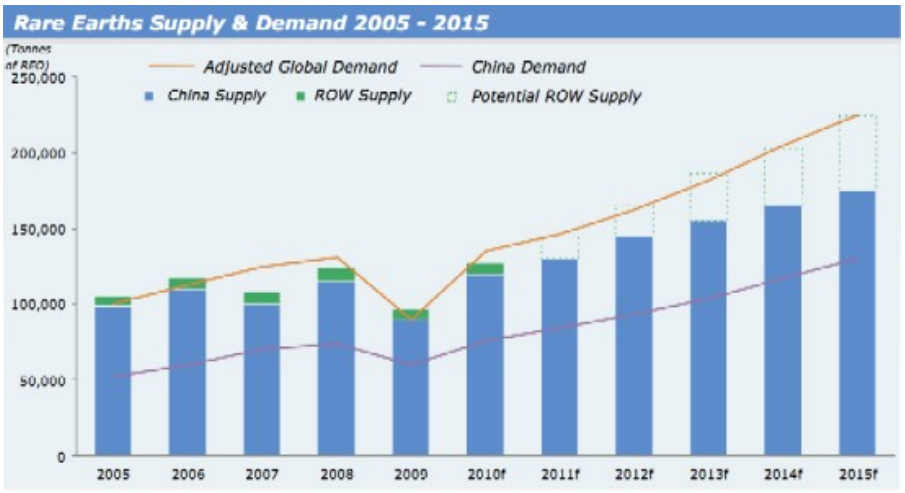

Figure 4 As global demand for rare earths (orange line) outstrips China's supplies (blue bars), its own domestic manufacturing will be the only place to find finished goods using them (source: Industrial Mineral Company of Australia).

Mountain Pass mine in California has now re-opened and is seeking to free the U.S. from its dependence on China for “Rare Earth” metals. Mountain Pass was mined in a larger scale between 1965 and 1995. During this time the mine supplied most of the world wide “Rare Earth” metals consumption. However, in 1998, chemical processing at the mine was stopped after a series of wastewater leaks. The environmental difficulties and expenses associated with the leaks along with the pressure of high labor expenses to produce a low cost product made the mine impractical to operate. However, with the increase in the “Rare Earth” market price, Mountain Pass has not only reopened, but is expanding. By the end of 2012, the company is aiming to produce 20,000 tons of “Rare Earths”. China, on the other hand, produced about 124,000 tons of “Rare Earths” in 2009.

How will this affect the Lighting Industry?

China's exports of “Rare Earths” in the first two months of 2011 came to 7,084 metric tons, according to data published by Hong Kong-based Economic Information & Agency, which publishes statistics it gets from China's General Administration of Customs. That is up just 0.3% from the first two months of 2010 but about half of what Beijing said would be permitted for sale overseas in the first six months of 2011. And at an average price of $44,361 a ton, the price was almost double last year's average of $23,603 and many times the price paid in the first two months of 2010.

So with the cost of “Rare Earth” metals for manufacturing being almost double that of last year the obvious impact of all of this is going to be higher prices to the consumer. Everything that uses the once forgotten about part of the periodic table will suffer cost increases, especially in the short run when everything has to come from China. The high lumen fluorescent products using tri-phosphor technology will be the hardest hit and the cost of LEDs are likely to remain high due to the extensive use of “Rare Earth” metals in these products. Some lighting manufacturers are proposing 30% to 50% price increases on some products.

Not a pleasant thought. But a fact of life.