

The Lanthanides, China, and High-Tech Autos (Actually High-Tech Everything)

By
Robert Bryce

FIGURE 20 The “Green Elements” and the Periodic Table

The Periodic Table

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra		Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cp	Uut	Uuq	Uup	Uuh	Uus	Uuo

lanthanides →	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Lanthanides description

Name	Symbol	Uses
Lanthanum	La	Batteries, catalyst in oil refining
Cerium	Ce	Glass and lens production, catalytic converters
Praseodymium	Pr	High-strength magnets, electronics, pigments
Neodymium	Nd	High-strength magnets, electronics, lighting
Promethium	Pm	X-ray units
Samarium	Sm	High-strength magnets, glass
Europium	Eu	Lighting, video screens
Gadolinium	Gd	Magnetic resonance imaging, video screens
Terbium	Tb	High-strength magnets, lighting, video screens
Dysprosium	Dy	High-strength magnets, video screens
Holmium	Ho	Glass tint
Erbium	Er	Metal alloys
Thulium	Tm	Lasers
Ytterbium	Yb	Metal alloys
Lutetium	Lu	Catalyst, metal alloys, nuclear technology

A Closer Look at A Few Of The Lanthanides

Lanthanum: Atomic number: 57

A critical element for use in nickel-metal hydride batteries. A Prius has about 10 kilos of lanthanum in its battery pack. A critical element for use in oil refining: catalytic crackers used to process heavier grades of crude rely heavily on lanthanum-based catalysts. Also used in steel production. Small amounts are used in pool products to remove the phosphates that feed algae.

Neodymium, atomic number: 60

Neodymium-iron-boron magnets are powerful, lightweight, and relatively cheap – at least they are when compared to the magnets they replaced, which were made with samarium (another lanthanide) and cobalt. The Toyota Prius uses neodymium-iron-boron magnets in its motor-generator and its batteries. Each Prius containing about 1 kilogram (2.2 pounds) of neodymium.¹

The American wind energy sector is almost wholly dependent on neodymium-iron-boron magnets, which are used inside wind turbines. General Electric reportedly buys all of the neodymium-iron-boron magnets used in its wind turbines from China. Neodymium magnets are substantially cheaper than are samarium-cobalt magnets. World production is about 7,000 tons per year.

Samarium: Atomic number: 62

Used as a neutron absorber in nuclear reactors. It is also used in headphone magnets and in magnetic pickups in electric guitars.

Terbium: atomic number: 65

Terbium can help cut the electricity usage of lights by 80 percent

¹ Steve Gorman, “As hybrid cars gobble rare metals, shortage looms,” Reuters, September 2, 2009. Available: <http://www.reuters.com/article/GCA-BusinessofGreen/idUSTRE57U02B20090902>. Keith Bradsher, “China Tightens Grip On Rare Minerals,” *New York Times*, September 1, 2009. Available: http://www.nytimes.com/2009/09/01/business/global/01minerals.html?_r=1&sq=neodymium&st=Search&scp=1&pagewanted=all

Between 2003 and 2008, Terbium prices quadrupled hitting some \$407 a pound. Those prices recently fell to about \$200 a pound.² Terbium is used in green phosphors in fluorescent lights and in color TVs. They combine with Europium's phosphors to provide trichromatic lighting.

Dysprosium, atomic number: 66

Tiny quantities of dysprosium can make magnets in electric motors lighter by 90 percent. Since 2003, dysprosium prices have climbed nearly sevenfold, to \$53 a pound. It's also used to make control rods in nuclear reactors.

Online Resources

www.molycorp.com

www.raremetalblog.com

<http://www.periodicvideos.com/#>

<http://www.iags.org/rareearth0310hurst.pdf>

http://minerals.usgs.gov/minerals/pubs/commodity/rare_earths/

http://minerals.usgs.gov/minerals/pubs/commodity/rare_earths/mcs-2010-raree.pdf

² Keith Bradsher, "Earth-Friendly Elements, Mined Destructively," *New York Times*, December 25, 2009,

http://www.nytimes.com/2009/12/26/business/global/26rare.html?_r=1&hp=&pagewanted=all