

Rare-Earths: Market and Main Applications

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The market and main applications of rare-earths are discussed. The production of rare earths in Brazil can be relevant for many high technology industries. The three main applications of rare-earths, in terms of price and volume, have been magnets, luminescent phosphors and catalysis. The most abundant rare-earth is cerium, which is mainly used in catalysis and glass polishing. Cerium is also used for glass coloring. However, cerium is cheap, because it is very abundant. At the present time, the rare-earths with highest price are europium, terbium, dysprosium, neodymium and praseodymium. The high price of Tb, Dy, Nd and Pr is due to the demand for permanent magnets of the Nd₂Fe₁₄B type. Europium and terbium are used in luminescent phosphors, with europium compounds producing red and blue light and terbium compounds originating the green light. This gives the white color, according the RGB system. However, after the blue LED was invented (based on GaN or InGaN compounds), the white color can be obtained by using a blue LED coupled with a yellow luminescent phosphor of the YAG type (Yttrium- Aluminium-Garnet) doped with cerium. Thus, the demand for europium is decreasing and the price of europium reduced significantly along 2015. Besides, other luminescent compounds free of rare earths have been investigated for producing red, green and blue colors, and this contributes for reducing the demand for europium. Lanthanum has high demand for catalysis. The oil industry uses lanthanum for the stabilization of zeolites used in oil cracking. Other important application of lanthanum is in Ni-La-H batteries. The Ni-La-H batteries have been successfully used in hybrid cars, and one of their advantages is that they may resist with low degradation after many charges and recharges. Many rare earths have demand for lasers used in optical fibers, as Nd, Pr and Er. Yttrium has many applications, as for example luminescent phosphors, lasers, superconducting tapes, and zirconia stabilized with Ytria (YSZ). Samarium is used in SmCo or SmFeCoCuZr magnets, but the high price of cobalt has limited this application. Magnets can be used in high efficiency motors and generators. For example, motors of electric cars, in general, use rare-earth magnets. Wind turbines also can be improved with the use of magnets. The direct drive wind turbines use rare-earth magnets, and perform well even with low wind. Around 45% of the Electrical energy of the world is used in electrical motors, with illumination accounting only for ~ 20%. Thus, high efficiency electrical motors, which employ rare-earth magnets, are an area of high demand in the near future. Types of high efficiency electrical motors are discussed as for example the permanent magnet synchronous motors, which also are used in electric and hybrid cars.

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