

# REE

## GENERAL DEFINITION

REE are non-toxic elements found in the Earth's crust, in the same way as tin and nickel. However, their applications are such that they are currently enjoying increasing popularity.

They are mainly found in the environmental and armaments industries, and used in applications that help reduce energy consumption and the use of fossil fuels.

## DESCRIPTION

The U.S. Geological Survey lists 16 REE, comprising 15 lanthanides, ranging from lanthanum (57) to lutetium (71), and the metal yttrium. These elements have similar physical and chemical properties.

### REE CAN BE DIVIDED INTO THREE GROUPS:

- 1 Light rare earth elements (LREE), which comprise lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd) and samarium (Sm). LREE, which are more common and have less value, make up 98-99% of the resource.
- 2 Heavy rare earth elements (HREE), which include europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb) and lutetium (Lu). The latter are more rare and therefore have higher value.
- 3 Yttrium, which is often found with HREE.

Here is an example of the difference in value between LREE and HREE. Europium (HREE) is currently worth US \$450/kg, whereas cerium sells at US \$4.50/kg. This explains why a mining property containing HREE has very significant value in the current situation.

## APPLICATIONS

REE are not found alone but as part of a group. It is therefore necessary to separate them. Given the desire of governments and the advent of a more environment-friendly economy, the demand for REE is experiencing strong growth. They also have numerous applications in the field of armaments and new technologies, including:

- the creation of new materials, such as thin films and high-strength magnets;
- the advance in renewable energies; they are found in windmill turbines and solar energy panels;
- the increase in energy efficiency of engines with LEDs and rechargeable batteries;
- hybrid or electric cars.

## THE MOST COMMON USES OF REE

- › **Green and renewable energies: windmill blades, solar panels**
- › **Miniaturization: small-scale electric motors (vacuum cleaner, compressor, washing machine and dryer), miniature loudspeakers (iPod, earphones), light emitting diodes, etc.**
- › **Medical field: MRI machines to obtain images and medical diagnoses, catalyst used for biomedical or chemical research, lasers and isotopes used for the treatment of cancer**
- › **Automobile manufacture: battery, electric motor, hybrid car generator**
- › **Computers and multimedia: computer monitors, plasma TVs, DVD and CD-ROM players**

## REE IN THE WORLD

These elements, which have been exploited since the late 18<sup>th</sup> century, are found throughout the Earth's crust. However, until now China has had a monopoly on world production with a rate higher than 95%.

Recently, there have been developments and research projects in Australia, United States and Canada. These plans are still at the exploration stage and will not come into production for another 4-5 years.

In the meantime, China plans to increasingly reduce the amount it exports, raising the spectre of a shortage on the horizon.

Given the growing demand for REE, rising by 10-20% per year according to the specialists, the development and commercial production of other deposits is becoming a necessity for the West.

## KEY FACTS

- China is responsible for 97% of the world's REE production.
- Demand for REE is likely to increase between 10 and 20% each year.
- At the end of 2015, China will no longer be exporting REE.
- Dysprosium and Terbium, are two of the most valuable REE used in green technology and military applications.
- Toyota Prius consumes 2 to 4 pounds of neodymium for every electric motor.
- The REE are called rare because they are widely dispersed and need to be separated.
- What makes REE an increasingly sensitive topic is their role in national defense
- Shortage situation has led to higher prices and difficulties for some suppliers in obtaining their element.