

What is the meaning of rare earth environmental sciences essay



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What is the meaning of rare earth?

Rare earth metals or rare earth elements (REE) are as a cluster of seventeen chemical elements in the periodic table, specifically the fifteen lanthanides and more yttrium and scandium. Yttrium and scandium are considered rare earth elements since they incline to occur in the identical ore deposits as the lanthanides and display analogous chemical properties. China is the biggest rare earth elements manufacturer in the world. Currently, China is becoming more disinclined to deliver these elements to the worldwide investors which are causing an enormous disruption on the global scale. It is important to first understand these rare earth elements and their main uses in order to understand their global significance.

What are rare earth elements?

Rare earth elements fundamentally consist of 17 rarely found elements which are present in the periodic table. Except these 17 rare elements, 15 elements come with Lanthanide series. These 15 Lanthanides and 2 additional elements, Yttrium as well as Scandium are together known as rare earth elements. Figure 1 indicates the Lanthanide Series plus Scandium and Yttrium.

Element (Symbol) (Atomic #)

Scandium (Sc)(21)Yttrium (Y) (39)Lanthanum (La) (57)Cerium (Ce)

(58)Praseodymium (Pr)(59)Neodymium (Nd) (60)Promethium (Pm)

(61)Samarium (Sm) (62)Europium (Eu) (63)Gadolinium (Gd) (64)Terbium

(Tb) (65)Dysprosium (Dy) (66)Holmium (Ho) (67)Erbium (Er) (68)Thulium (Tm) (69)Ytterbium (Yb) (70)Lutetium (Lu) (71)

Figure 1: The Lanthanide Series additionally Scandium and Yttrium. These rare earth elements are named as rare earth metals as well because all of these elements are fundamentally metals in nature. These elements are usually found together in the form of geological deposits. There is a global debate whether or not to think through Scandium as a rare earth element. However, according to the sources from the International Union of Pure and Applied Chemistry, Scandium is involved in the rare earth elements category.

Producers of rare earth elements in the world

There are very few countries which have rich resources of rare earth elements. As mentioned amongst the countries which produce rare earth elements, China is the main actor in the world. Figure 2: Global REE production. It is supposed that the biggest rare earth elements deposit stays in the Bayan Obo zone of China. It has been discovered 95 million tons of rare earth elements in the world and nearly 47 million tons of rare earth elements are in China. Other countries which are producing rare earth elements are India, Australia, Canada, Malaysia, Brazil and USA.

What are rare earth usages?

http://www.matamec.com/vns-site/page-rare_earths_elements-en.html

'res0_0' Rare earth elements are being used at several industries. The main uses are in the electrical and electronic areas. Most of the rare earth elements are being used in variety of electronic devices such as computer memory, mobile phones, DVDs, car catalytic converters, rechargeable

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batteries, fluorescent lighting, and several other instruments. The global demand for all mentioned electronic devices and instruments has reached to tremendous level nowadays. In petroleum refining, metallurgy, chemical catalysts, catalytic converters, magnet production, monitors, televisions and so on industries, rare earth elements need is tremendous. For example rechargeable batteries are made only through the help of rare earth elements. These batteries are largely used to power up electronic devices such as computers, cameras, laptops, hybrid vehicles and electronic vehicles. Rare earth elements are used are also used in the industries which make use of phosphors, catalysts and polishing compounds. These types of phosphors, catalyst and polishing compounds are illuminating screens of several electronic devices beside optical quality glass. Through these phosphors and catalysts made up of rare earth elements air pollution control is possible too. We will look into one of the most significant rare earth uses in the cell phone industry deeply.

Rare Earth Elements in Cell Phones

All smart phones are consisting full of rare earth elements. The companies such as Apple, Samsung are richer than many countries and their profits reached the enormous numbers. Their products are containing of many rare earth elements. When such profits are existing over rare earth elements, the importance of REE are increasing every day. Some companies are even thinking about mining the moon. These companies' strategies will be their future and effect even global power balance. Currently China has power for rare earth elements and it is biggest producer and consumer of REE. Let's have a look inside our cell phones. The graph below shows how rare earth

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elements are being used in the iPhone and other smart phones. These elements make smart phones light, bright, loud and make them having extra functionalities. Figure 3: The periodic table of iPhones and other smart phones As you see an iPhone contains many rare earth elements and can be a lecture in high school chemistry. These elements are doing everything from making the reds on the screen pop or when a call comes in having the phone vibrate Figure 4: How rare earth metals are used inside smart phones.

What is Apple's Rare earth Procurement Strategies and Why Apple stuck in Chinese mud?

China currently produces the major part which is 95 percent of the world's rare earth element supply. They can easily control this market and they cut export quotas. As a result the prices of rare earths are increasing. The EU, Japan and US complaint the China's rare earth practices to World Trade Organization. Rare earth elements are yet another reason and one of the most important reason why Apple cannot withdraw manufacturing in China and move to other countries. The fact is companies such as Apple and other electronic makers can only be except from China's quotas for rare earth elements by manufacturing within the country. Major part of the components of iPads and iPhones are currently produces in China and their supply chain is naturally mostly in China. Assembling the phones far away is causing huge challenges for logistical operations. In addition this is decreasing the flexibility and the ability to switch from one component manufacturer or supplier to another. China's factories are now much larger than the factories in United States. They can hire and fire many of workers basically overnight. And they can rapidly change manufacturing speeds and practices. China's

workforce is more frugal and much hungrier than workers in United States.

And lastly China now has a bigger supply of qualified and appropriate engineers than United States. The necessary technical skills to build complex gadgets cost too much.

Apple's Non-Chinese Strategies

What iPhone tries to do in order to decrease dependence on China? Some of tires are finding new resources and try to use environment friendly way to mine rare earths in USA. Find new rare earth mines. Improve recycling technologies. Furthermore decrease to use of rare earths and find alternative metals. There is a mine in California which called Molycorp Mountain Pass specializes in finding rare earth elements. Mark Smith, Molycorp CEO says " If you and I can only buy Blackberry's and iPhones that require rare earths but the only rare earths that go into them come from China—what happens if they pull that out of the supply chain?" Molycorp is currently in a hurry of building and improving its mining sites to meet the need for rare earth elements of U. S. John Burba, Molycorp vice-president of technology says that " It's very motivating... everyone is dedicated because they fully understand we have to supply non-Chinese elements to the industry." In U. S Molycorp is the only mine producing rare earth elements currently. Molycorp invited the media into its facility as it prepares to begin processing rare earth elements, not only mining it, after almost 10 years. The process begins with gathering ore-laden rocks and graving them. From here, the powder requires a chemical bath to extract the elements. Keith Long who is says a mineral economist and geologist with the U. S. Geological Survey. " It's a high priority from our government to advance for wind energy and rare earth. So we're

very concerned about the security and supply of those." He teaches graduate-level lessons in mining at the University of Arizona, Tucson. He says now is a vital time for non-Chinese resources of rare earth elements to be harvested. Molycorp's facility will increase production significantly. It's being rebuilt to manufacture about 40, 000 metric tons of rare-earth metals by 2013, which means 700 percent enlargement from its target for the end of this year in Mountain Pass, California." We want people who buy from us to know we do things the right way," said Mark Smith, Molycorp CEO, who says Molycorp has a new, environmentally friendly mission. He said." We care about the environment and we care about what we do, and we think that makes a difference with customers today," Just off of its own exit on Interstate 15, about an hour's drive from Las Vegas, the Mountain Pass mining site is nestled in a small valley between two mountain ranges in the desert. The carbonatite deposit, which contains a variety of ore types, was discovered by prospectors in 1949, according to a U. S. geologist. About 8 percent of the deposit contains rare-earth minerals, a good ratio in rare-earth mining. Seventeen elements on the periodic table of elements are considered rare earth, including neodymium and terbium. Molycorp mines 10 of the rare-earth elements by hauling ore-laden rocks from the ground, crushing them, and then chemically extracting the elements." Molycorp picked it up pretty quickly and really developed the mine," said Keith Long, a mineral economist and geologist with USGS, who believes Molycorp is a pioneer in the technology to extract rare-earth elements. Molycorp remained a big player in the global market even as it competed for the lowest price with China, according to Long." Starting in the 1980s, China was able to start taking over the rare-earth market, which it was able to do because its mining

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industry is at a primitive, low-cost model," he said. A large, open earth pit that looks like the impression an upside-down pyramid would make sits in the midst of the desert at Mountain Pass. Trucks that can hold up to 75 metric tons of dirt carefully wind past other trucks, hugging the sides of the boxy pit walls. The pit is about 150 meters deep. The scale makes workers' trucks, parked near the top of the pit, look like children's toy cars. There is a small pool of water in the center of the pit, but the trucks are driven to one of the sides, where earth is pushed into the beds of the trucks, then driven back out. The pit is being expanded and prepared to harvest ore, where a likely looking deposit for heavy concentration of rare-earth minerals has been flagged with a large orange " X." Molycorp is in phase one of its reopening, and employees are proud to take reporters around the 2, 222-acre facility, where new buildings are going up in all directions. Molycorp is building a combined heat and power plant, a wastewater recycling center, a rock cracking and chemical leaching facility, and a post-processing facility for the waste rock processing and storage facility. Molycorp is about to have company, which its CEO says is welcome. An Australian rare-earth metals mine owned by Lynas is set to open by the end of 2011, according to information on its website. There are nine bills before the U. S. Congress now, relating to either finding more rare-earth minerals, protecting rare-earth elements for munitions supplies or recycling electronic components that have rare-earth elements inside them. And the U. S. Department of Defense released a report last month saying the U. S. is too dependent on Chinese rare-earth minerals." It is essential that a stable non-Chinese source of REO [rare-earth oxides] be established so that the U. S. RE supply chain is no longer solely dependent on China's RE exports," the report states. It takes <https://assignbuster.com/what-is-the-meaning-of-rare-earth-environmental-sciences-essay/>

10 to 15 years for an ore deposit to develop into a rare-earth mining site, due to funding and permitting, which meant China's export hold put the world supply of rare-earth elements in jeopardy." We were fortunate that two projects were in advanced stages when this crisis hit," Long said. Still, geologists expect that the demand for rare-earth minerals will exceed the available world supply until at least 2015. As a result of the increased demand and tightening restrictions on exports of the metals from China, some countries are stockpiling rare earth resources. Searches for alternative sources in Australia, Brazil, Canada, South Africa, Tanzania, Greenland, and the United States are ongoing. Mines in these countries were closed when China undercut world prices in the 1990s, and it will take a few years to restart production as there are many barriers to entry One example is as mentioned the mine in California. Other significant sites under development outside of China include the Nolans Project in Central Australia, the remote Hoidas Lake project in northern Canada, and the Mount Weld project in Australia. The Hoidas Lake project has the potential to supply about 10% of the \$1 billion of REE consumption that occurs in North America every year. Vietnam signed an agreement in October 2010 to supply Japan with rare earths from its northwestern Lai Châu Province. As USA an apple tries to decrease the dependence on China, South Korea and Samsung is trying to decrease dependence too. South Korea's dependence on rare earth elements (REEs) from China fell last year as the country diversified its import base, according to a report by China's Global Times. For the January to November period, REE imports from China accounted for 54.4 percent of total imports, down from 78.4 percent in 2011, according to the Korea Customs Service. The report adds that the drop in imports was the result of <https://assignbuster.com/what-is-the-meaning-of-rare-earth-environmental-sciences-essay/>

the relatively high price of REEs imported from China — prices averaged \$39.21 in 2012, " equal to 101.3 percent of the average price of total imports. The ratio was higher than 91.3 percent in 2011." Meanwhile, REE imports from Japan increased to 27.9 percent last year from 7.8 percent in 2011.

Recycling: What cell phone makers have to learn from EV companies?

Another recently developed source of rare earths is electronic waste and other wastes that have significant rare earth components. New advances in recycling technology have made extraction of rare earths from these materials more feasible, and recycling plants are currently operating in Japan, where there is an estimated 300,000 tons of rare earths stored in unused electronics. In France, the Rhodia group is setting up two factories, in La Rochelle and Saint-Fons, that will produce 200 tons a year of rare earths from used fluorescent lamps, magnets and batteries. Recycling rates for rare earth metals being used in electric and hybrid vehicles are miserably low, according to a new report out of the U. N.'s environmental branch (PDF). Apparently, less than 1 percent of these materials is being recycled and reused, which is utterly unsustainable. This could spell doom for the green technology sector if major changes aren't made in the next several years. But alternative energy cars aren't the only culprits in the rare earth metal recycling game. Cell phones are also a prime suspect, containing several extremely rare elements that are not as commonly recycled as they need to be. According to the U. S. Geological Survey, close to 200 million cell phones are retired every year, collectively containing upwards of 2,000 metric tons of copper, 50 metric tons of silver, 4 metric tons of gold and 2 metric tons of

palladium. These are all materials that could be recycled and reused in future cell phones. The situation is only becoming more dire as consumers switch to smartphones, which rely even more heavily on rare metals. Recycling isn't an issue solely because it would reduce material costs. It's also pressing because of the mounting e-waste crisis — the fact that landfills around the world are now home to tons upon tons of discarded and non-biodegradable cell phones, computers, printers and more. On top of that, many tech products contain materials like neodymium, europium, cerium and terbium, which are toxic. Neodymium is particularly hazardous if it seeps into groundwater, since it can cause serious health problems. Rare earth metals are also, increasingly, a foreign policy issue. China controls up to 95 percent of the rare earth metals on the planet. The U. S. imports the bulk of the rare earth metals used in products manufactured domestically. So the U. S. could wean itself off of foreign oil only to find itself addicted to foreign metals for technology products consumers refuse to live without. Recycling is the logical solution to all of these concerns. It's far cheaper to extract elements that can be reused from existing products than to continue mining them from the earth. A compulsory electronics recycling program would greatly reduce the amount of dangerous e-waste at home and abroad. And, it would diffuse international tensions over rare earth metal supplies. Efforts to recycle more electronics, particularly computers and cell phones, are underway. The majority of electronics retailers now allow customers to turn in retired products so that they can make sure they are disposed of efficiently and responsibly. Even hardware makers like Apple allow customers to ship their used products back for proper recycling. These strategies attempt to make recycling the easy, natural choice. But they don't

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go far enough yet. Because they are opening up an entirely new industry, electric car companies have had to establish responsible recycling plans from the start. For example, Tesla Motors, maker of the electric Roadster, is emphatic about its closed-loop recycling program and its mechanism for recycling and reusing the lithium and other materials that go into its batteries and motors. It will be hard for an EV maker — even the bigger brands that are now turning to EVs — to get off the ground without talking about the importance of recycling. But the cell phone industry faces a tougher battle. It has been around for so many years without raising recycling as a major concern. Also, it's much easier for someone to toss a phone in the trash than a car. That said, phone makers would be well-advised to follow in EV companies' footsteps, by stressing not only the ease of recycling their products, but also how and why it's so important from a global health perspective.

What is the future of global market that has increasing demand for rare earth elements?

The global demand for several electronic devices, instruments, defense equipment, magnets, and pollution control catalysts is continuously rising every year. China is still the most dominant player in the production of rare earth metals and alloys. China has also restricted the export of these valuable elements to some extent. This emphasizes the need to find more natural resources of rare earth elements across the globe.