

Mineral Products and Metals that make LED Light Bulbs



- **Arsenic (semiconductor chips):** Mined in China, Chile, Morocco, Peru, Kazakhstan, Russia, Belgium and Mexico.
- **Barite (barium/aluminum oxide for phosphor):** Mined in China, India, United States, Morocco, Iran, Turkey, Mexico, Kazakhstan, Vietnam, Germany, Russia, Algeria and United Kingdom.
- **Bauxite (alumina for glass and aluminum for adapters):** Mined in Australia, China, Brazil, India, Guinea, Jamaica, Russia, Venezuela, Suriname, Kazakhstan, Guyana and Greece.
- **Boron Minerals (semiconductor chips):** Mined in United States, Turkey, Argentina, Chile, Russia, Peru, China, Bolivia and Kazakhstan.
- **Copper (adapters and wiring):** Mined in Chile, United States, Peru, China, Australia, Russia, Indonesia, Canada, Zambia, Poland and Mexico.
- **Gallium (semiconductor chips):** Mined in China, Germany, Kazakhstan and Ukraine.
- **Indium (semiconductor chips):** Mined in China, Republic of Korea, Japan, Canada, Belgium, Russia, Peru and Brazil.
- **Lead (adapters and glass):** Mined in China, Australia, United States, Peru, Mexico, Canada, India, Poland, Russia, Sweden, Ireland and South Africa.
- **Limestone or Dolomite (soda-lime glass):** Mined in United States.
- **Manganese (for phosphor):** Mined in South Africa, Australia, China, Gabon, Brazil, India, Ukraine and Mexico.
- **Nickel (adapters):** Mined in Russia, Canada, Australia, Indonesia, New Caledonia, Philippines, Columbia, China, Cuba, Brazil, Botswana, South Africa, Dominican Republic, Greece, Venezuela and Spain.
- **Phosphate Rock (semiconductor chips):** Mined in China, United States, Morocco and Western Sahara, Russia, Tunisia, Jordan, Brazil, Syria, Israel, Egypt, Australia, South Africa and Canada.
- **Rare Earth Oxides (for phosphor):** Mined in China, India and Brazil.
- **Silica (glass):** Mined in United States, Italy, Germany, United Kingdom, Australia, France, Spain, Japan, Poland, Hungary, South Africa, Mexico, Austria, Iran, Republic of Korea, Slovakia, Canada, Belgium, India, Bulgaria, Norway, Chile, Gambia, Turkey and Czech Republic.
- **Selenium (semiconductor chips):** Mined in Japan, Belgium, Canada, Russia, Chile, Philippines, Finland, Peru, Sweden and India.
- **Soda Ash (soda-lime glass):** Mined in United States, Kenya and Botswana.
- **Tin (adapters; glass coatings):** Mined in China, Indonesia, Peru, Bolivia, Brazil, Congo-Kinshasa, Vietnam, Malaysia, Australia and Russia.
- **Zinc (adapters; semiconductors):** Mined in China, Peru, Australia, United States, Canada, India, Kazakhstan, Ireland and Mexico.

INTERESTING FACTS

- LEDs are small light sources that become illuminated by the movement of electrons through a semiconductor. LED colors are caused by different semiconductor materials.
- LEDs are made of soda-lime glass, similar to that used throughout the glass industry for bottles and other common products.
- Phosphor-based LEDs are the most popular for manufacturing high-intensity white LEDs. Phosphor in an LED is a phosphate mix that may contain manganese, rare earth elements such as lanthanum, and yttrium as either an oxide or a phosphate, along with barium/aluminum oxide. Phosphor components may vary slightly depending on the color of the lamp.
- LEDs do not contain mercury as do compact fluorescent lamps (CFLs) so disposal concerns aren't the same.
- As LED light bulbs age, the output slowly decreases as the LED lamp loses its initial efficiency. The LED has reached the end of its life when its light output reaches 50% of the rated output and not when the LED bulb gets to the point of emitting 0% of its rated initial output.
- The lifespan for LEDs is about 30,000 hours. That averages about 6 hours of light per day for 12 years.
- The U.S. possesses the largest non-China rare earth resource in the world at the Mountain Pass Mine, located in California.

SOURCES

Researcher: Brian Harris,
Colorado School of Mines

Edited by the U.S. Geological Survey 2010

Sources:

- <http://minerals.usgs.gov/minerals/pubs/mcs/>
- U.S. Geological Survey 2010 Mineral Commodity Summaries, <http://minerals.usgs.gov/minerals/pubs/mcs/2010/mcs2010.pdf>
- Eartheasy.com, 2010, http://eartheasy.com/live_energysave_lighting.htm
- TCP, Inc., Material Safety Data Sheet, 3/16/09, http://www.tcpi.com/PDF/2102_40658_TCP_LED_MSDS_SS.pdf
- C. Crane Company, Inc., <http://www.ccrane.com/lights/led-light-bulbs/led-lighting>
- U.S. Environmental Protection Agency and U.S. Department of energy, 2010, Energy Star Program, LEDs, http://www.energystar.gov/index.cfm?c=lighting.pr_what_are
- Wikipedia, LEDs, http://en.wikipedia.org/wiki/Light-emitting_diode
- <http://www.molycorp.com/default.asp>