

Cadmium

Edward Klimasauskas, the cadmium commodity specialist for the U.S. Geological Survey, has compiled the following information on cadmium, a mineral constituent used in rechargeable batteries.

Cadmium, which was once used almost exclusively for pigments, now has many diverse applications. Cadmium's low melting point, excellent electrical conductivity and resistance to corrosion make it valuable for many products including batteries, electroplated coatings, stabilizers for plastics, solar cells and nonferrous alloys. Today's cadmium is primarily used in rechargeable batteries, accounting for about 78 percent of consumption in 2004. In 2000, an estimated 3.5 billion consumer batteries were sold in the United States, of which almost 10 percent were nickel-cadmium batteries.

Because cadmium is never found in nature as a native metal, its discovery came relatively recent. The metal was first separated from an unusual sample of zinc ore by Friedrich Stromeyer of Germany in 1817. He named it "cadmium," after cadmeia, an ancient Greek word used to describe calamine — zinc oxide — ores. Primarily, cadmium sulfide pigment was used for paint in the 19th century.

Only a few cadmium minerals are known — greenockite, hawleyite and otavite — and they are associated with zinc minerals. Strata-bound zinc deposits, also known as Mississippi Valley-type deposits, are the most commercially important type. Zinc deposits suitable for extracting cadmium occur throughout the world, but China, Australia, the United States, Canada and Kazakhstan possess about 64 percent of the world reserve base.

In 2004, world refinery production of cadmium was about 17,200 metric tons, and, in descending order, China, Japan, Republic of Korea, Kazakhstan and Canada were the leading producers. The United States accounted for about 3.5 percent of the world refined production, a decrease of about 0.5 percent from that of 2003.

Cadmium use is concentrated in industrialized countries; only six countries account for 85 percent of world consumption. Japan is the leading consumer, followed by Belgium and the United States. In 2000, an estimated 13 percent of cadmium consumption in the United States came from recycled batteries and materials. However, cadmium usage in developed countries has declined in recent years owing to its toxicity.

The U.S. Environmental Protection Agency lists cadmium as a bioaccumulative pollutant and has set a target to reduce cadmium use by 50 percent by 2005. Cadmium can damage the lungs, and cause kidney disease and cancer. Exposure usually occurs in the workplace where cadmium products are made. The general public is exposed from breathing cigarette smoke or eating cadmium-contaminated foods, such as shellfish, liver or kidney meats. Consumer batteries make up only an estimated 1 percent of municipal solid waste but contribute a disproportionately high percentage of cadmium to the waste stream. The European Union is considering a ban on all nickel-cadmium batteries containing more than 0.002 percent cadmium starting in 2008.

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Sample of cadmium metal with penny for scale. Image from *Minerals in Your World*.