

Indium

Indium is a chemical element in the periodic table that has the symbol **In** and atomic number 49. This rare, soft, malleable and easily fusible poor metal, is chemically similar to aluminium or gallium but looks more like zinc (zinc ores are also the primary source of this metal). Its current primary application is to form transparent electrodes from Indium tin oxide in liquid crystal displays. It is also widely used in thin-films to form lubricated layers (during World War II it was widely used to coat bearings in high-performance aircraft).

Notable characteristics

Indium is a very soft, silvery-white true metal that has a bright lustre. As a pure metal indium emits a high-pitched "cry" when it is bent. Both gallium and indium are able to wet glass.

One unusual property of indium is that its most common isotope is very slightly radioactive; it very slowly decays by beta emission to tin over time. This radioactivity is not considered hazardous, mainly because its decay rate is nearly 50,000 times slower than that of natural thorium, with a half-life of 4×10^{10} years; many thousands of times longer than the estimated age of the universe. Also, indium is not a notorious cumulative poison, like its neighbor cadmium, and is relatively rare.

Applications

The first large-scale application for indium was as a coating for bearings in high-performance aircraft engines during World War II. Afterwards, production gradually increased as new uses were found in fusible alloys, solders, and electronics. In the middle and late 1980s, the development of indium phosphide semiconductors and indium-tin-oxide thin films for liquid crystal displays (LCD) aroused much interest. By 1992, the thin-film application had become the largest end use. Other uses;

- Used in the manufacture of low-melting-temperature alloys. An alloy consisting of 24% indium and 76% gallium is liquid at room temperature.
- Some indium compounds such as indium antimonide, indium phosphide, and indium nitride are semiconductors with useful properties
- Can also be plated onto metals and evaporated onto glass which forms a mirror which is as good as those made with silver but has higher corrosion resistance.
- Its oxide is used in the making of electroluminescent panels.
- Used as a light filter in Low pressure sodium vapor lamps
- Indium's freezing point of 429.7485 K (156.5985 °C) is a defining fixed point on the international temperature scale ITS-90.
- Sometimes used as a component of nuclear control rods.

- Very small amounts used in aluminium alloy sacrificial anodes (for salt water applications) to prevent passivation of the aluminium

History

Indium (named after the indigo line in its atomic spectrum) was discovered by Ferdinand Reich and Hieronymous Theodor Richter in 1863 while they were testing zinc ores with a spectrograph in search of thallium. It is interesting to note that most elements were discovered while searching for other elements. Richter went on to isolate the metal in 1867.

Occurrence



Ductile Indium wire

Indium is produced mainly from residues generated during zinc ore processing but is also found in iron, lead, and copper ores. The amount of indium consumed is largely a function of worldwide LCD production. Increased manufacturing efficiency and recycling (especially in Japan) maintain a balance between demand and supply. The average indium price for 2005 was US\$900 per kilogram. This is unusually high. Demand increased as the metal is used in LCDs and televisions, and supply decreased when a number of Chinese mining concerns stopped extracting indium from their zinc tailings. In 2002, the price was US\$94/Kg; in 2006, the price is \$800/Kg.

Up until 1924, there was only about a gram of isolated indium on the planet. The Earth is estimated to contain about 0.1 ppm of indium which means it is about as abundant as silver, although indium is in fact nearly three times more expensive by weight. Canada is a leading producer of indium, producing more than 1,000,000 troy ounces (31,100 kg) in 1997.

Precautions

Pure indium in metal form is considered non-toxic by most sources. This may not be the case with indium compounds: there is some unconfirmed evidence that suggests that indium has a low level of toxicity. However, in the welding and semiconductor industries, where indium exposure is relatively high, there have been no reports of any toxic side-effects. Other sources are more definite about indium compounds' toxicity - for example, the WebElements website states that *"All indium compounds should be regarded as highly toxic. Indium compounds damage the heart, kidney, and liver, and may be teratogenic."* For example, indium trichloride anhydrous (InCl₃) is quite toxic, while indium phosphide (InP) is both toxic and a suspected carcinogen.

References

- [Los Alamos National Laboratory – Indium](#)