

# Learn About ...

## INDIUM



Pure indium is a soft, silvery metal. It is not found pure in nature, only in compounds with other elements. It is a fairly rare element, making up less than 1 part per million of the Earth's crust, about the same as silver.

The element was discovered by accident in 1863 by two German chemists, Ferdinand Reich and Hieronymous Theodor Richter. They were attempting to extract a different element, thallium, from an ore found near their laboratory. They tested their extract by heating it to see what color of light it emits. Their extract emitted a deep indigo color, which thallium does not do. Therefore, they knew that what they had was not thallium, but instead an element that was at the time still unknown. Because it emits indigo colored

light, they named their new element *indium*.

Because indium is rare, it is not produced directly from an ore, but as a by-product of the production of another metal, most often zinc. Indium is a minor component, less than 0.1%, of the mineral sphalerite, which is mostly zinc sulfide. When zinc is extracted from the mineral, trace elements such as indium accumulate in the waste. It is from this waste that the indium is extracted later. Because indium is a by-product, the amount produced depends on the amount of zinc produced. In 2012, the world production of indium was only 700 tons, and nearly half of that was produced in China, which is the world's largest producer. (For comparison, the annual world production of aluminum is about 60,000,000 tons, also mostly from China.)

Despite indium's scarcity, its use has increased rapidly over the past twenty years. One reason for this is the increasing demand for display panels on electronic devices like smartphones, computers, and televisions. Approximately 70% of all indium is used to make indium tin oxide (ITO) film. As a film, ITO is transparent, colorless, and a good conductor of electricity. The touch-screen devices you've used very likely had ITO film in them. If you're reading this article on your smartphone or tablet, you are holding a little bit of indium!

Indium is also used in some light-emitting diodes (LEDs). Two compounds used in LEDs contains indium and gallium, one with nitrogen and the other with phosphorus. These compounds are called InGaN and InGaP, respectively. InGaN is used in LEDs that produce green, blue, or white light, while LEDs that contain InGaP produce red, orange, or yellow. If you left the house today, you probably passed several traffic lights that contained LEDs. Some street lights and many holiday lights also contain LEDs. Many cell phones, as well as televisions and computer monitors, have liquid crystal



Red, Green, and blue LEDs

display (LCD) screens, which rely on ITO films, too.

Indium is a common replacement for mercury in some everyday items. Indium is now used in place of mercury in alkaline batteries. Some packages of alkaline batteries indicate that they are mercury-free. These batteries very likely contain indium. Indium (or, formerly, mercury) is added to batteries to suppress corrosion that can cause batteries to burst.

Indium is also a frequent addition to dental amalgam fillings (the shiny, metallic ones). Dental amalgams contain mercury, which can be toxic if it is swallowed or inhaled. Indium helps to keep mercury in the filling, preventing the filling from being toxic.

One of the more uncommon applications of indium is in a nuclear reactor. The rate of the reaction in a nuclear reactor is adjusted with control rods that are raised or lowered into the reactor. Some of these control rods are made of an alloy (a mixture of metals) that contains silver, cadmium, and indium.

In 2018, SCIENCE IS FUN presented the 49<sup>th</sup> annual *Once Upon a Christmas Cheery in the Lab of Shakhashiri*. To mark this anniversary, the program featured the element whose atomic number is 49, indium.

[\*\*View the 12-page printed Program\*\*](#)

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