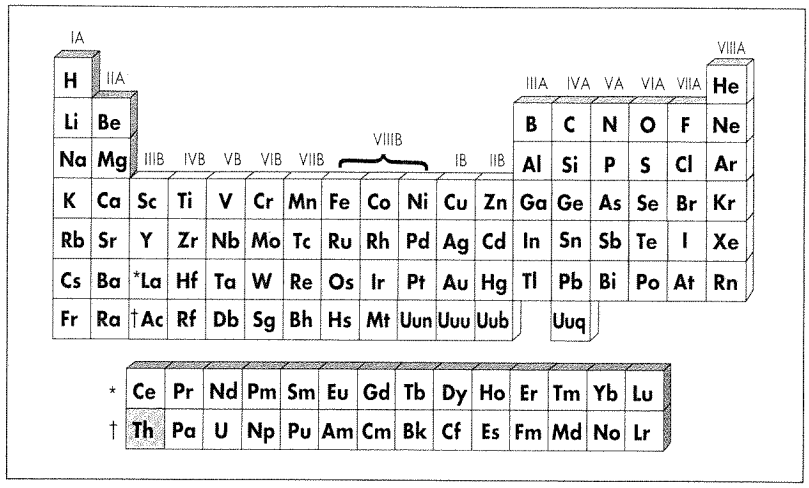
# THORIUM




Th

Thorium is a radioactive, silvery-white metal that tarnishes very slowly when exposed to air. After a few months, it reacts with the air to form a black oxide. Pure thorium is very soft and malleable. Its oxide has a melting point of 3,300°C, one of the highest of any oxide, and when finely subdivided, can be ignited to burn in air, producing a brilliant white light.

Thorium was discovered in 1828 by the Swedish chemist Jöns Jakob Berzelius, who named it for Thor, the Scandinavian god of war. He was unaware of its radioactivity because that was not known as a physical process until it was discovered by Henri Becquerel and the Curies in 1897. Thorium-232, the isotope of thorium that occurs naturally, is actually very weakly radioactive. Its half-life is an enormous 14 billion years, so that very little of it decays in a short period. The radiation it emits can nevertheless fog photographic film if left in contact with the film for several hours.

Thorium-containing ores are about as abundant as those of lead in the Earth's crust and about three or four times more abundant than uranium ores. Monazite sand, some of which is found as beach sand in Florida, can contain up to 10 percent thorium, and this sand is used for the commercial preparation of the element.

Thorium shows great promise of becoming an important source of nuclear energy in the future. When thorium-232 is subjected to a beam of neutrons, it undergoes several nuclear transformations to form an isotope of uranium called uranium-233. Uranium-233 can undergo nuclear fission in the same manner as uranium-235, the isotope now used throughout the world as a commercial source of nuclear power. Several experi-

Atomic Number **90**

Chemical Symbol **Th**

Group **IIIB—Transition Element (The Actinides)**


*Thorium oxide is used to make the mantles of portable gas lamps.*

mental prototype reactors using uranium-233 are currently under construction. Given the large quantities of thorium available on Earth, there are hopes that it will become a major future source of energy.

Thorium has some 25 known isotopes, with half-lives ranging from one-tenth of a millionth of a second to the 14 billion years of thorium-232, the longest-lived isotope of the element. When thorium-232 decays, it transmutes itself into 11 different elements before ending up as lead-208, a stable isotope of lead. This series of transformations is called the thorium decay series.

Despite its radioactivity, thorium metal and its compounds have several commercial applications. The metal serves as an alloying element for magnesium that must be subjected to high temperatures. Thorium also serves as a very efficient emitter of electrons for electronic devices. The brilliant light that thorium oxide emits when burning makes it useful in fabricating certain types of portable gas lamps.

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