

Tantalum

U.S. Geological Survey Tantalum Commodity Specialist Larry D. Cunningham has prepared the following information on tantalum — a specialty metal used mostly in the production of electronic components, cutting tools and superalloys.

Tantalum is a metal that is critical to the United States because of its defense-related applications in aircraft, missiles and radio communications. It is ductile, easily fabricated, highly resistant to corrosion by acids, a good conductor of heat and electricity, and has a high melting point. Tantalum's first commercial usage was as filament material in incandescent electric lamps in the early 1900s.

Currently, more than 60 percent of total tantalum consumed is in the electronics industry, mainly in the form of tantalum metal powder used in the manufacture of tantalum capacitors. Major end uses for tantalum capacitors include automotive electronics, pagers, personal computers and portable telephones.

Alloyed with other metals, tantalum is also used in making carbide tools for metalworking equipment and in the production of superalloys for aircraft engine components. In 2003, estimated overall U.S. consumption of all tantalum materials was about 500 tons. World mine production in 2003 was about 1,230 tons.

The principal source of tantalum is a series of minerals that contain columbium (niobium), iron, manganese and tantalum oxides. There has been no significant U.S. tantalum mining since 1959. U.S. tantalum resources are of low grade, some are mineralogically complex, and most are not commercially recoverable. With no tantalum mining industry, the United States must import all its tantalum source materials for processing.

On a worldwide basis, identified resources of tantalum are considered adequate to meet projected needs. Tantalum mineral production comes mostly from mining operations in Australia, Brazil and Canada, as well as from smaller mining operations in some African countries. Australia, which is the largest producer, accounts for more than 60 percent of the world's annual requirements for tantalum mineral concentrates. In 2003, Australia accounted for about 56 percent of total U.S. tantalum imports. Tantalum is also obtained from low- and high-grade tantalum-bearing tin slags, which are byproducts from tin smelting, principally from Asia, Australia and Brazil. However, the overall importance of these byproducts has decreased, with the exception of accumulated inventories, owing to the downsizing of the tin industry during the 1980s.

To ensure supplies of tantalum during an emergency, various tantalum materials have been purchased for the National Defense Stockpile (NDS). At year-end 2003, the NDS tantalum inventory consisted of about 628 tons of tantalum contained in tantalum materials valued at about \$34 million, all of which was authorized for sale by the Defense Logistics Agency.

The price for tantalum products is affected most by events in the supply of and demand for tantalum minerals. Faced with runaway tantalum mineral prices during the late 1970s through

1980, processors were forced to pass along a large part of the price increases to end users, which had the effect of a decrease in the use of tantalum.

Because of escalating tantalum prices, consumers began to substitute alternative products, to decrease tantalum content in products and to increase recycling. In the consumer electronics sector, some circuits were redesigned, and tantalum was replaced primarily with aluminum-bearing electronic components.

Tantalum was recycled mostly from new scrap that was generated during the manufacture of tantalum-related electronic components. Recycled tantalum also comes from new and old scrap products of tantalum-containing cemented carbides and superalloys. Detailed data on the quantities of tantalum recycled in the United States in 2003 are not available, but recycled tantalum may compose as much as 20 percent of consumption. Substitutes, such as aluminum, rhenium, titanium, tungsten and zirconium, can be used in place of tantalum, but are usually used at the expense of either performance or economics.

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Sample of tantalum, ballpoint pen for scale. Image from USGS.