

Tin

James F. Carlin Jr., the tin commodity specialist for the U.S. Geological Survey, has compiled the following information on tin, an important industrial metal.

Tin was one of the first metals discovered by humans and, like most metals, tin is rarely used by itself. Most tin is used as a protective coating or as an alloy with other metals in a diverse range of commercial and defense applications.

During the past century, tinplate was the dominant consumption category for tin. A thin, flat-rolled steel industry product, tinplate has a coating of tin on both sides and is used to make tin cans. In the early 1960s, however, tinplate consumption declined substantially, with the introduction of the aluminum can, coupled with the fact that the canning industry found that it could use thinner tin coatings and still achieve desired corrosion resistance.

Now, solder, an alloy of approximately 70 percent tin and 30 percent lead, is the dominant tin product. Significant amounts of solder are used in the construction and transportation industries, but the major use is in electronics, where it finds applications in virtually all modern high technology, ranging from computers to microwave ovens. As government regulation has reduced the presence of lead in society, tin has gained market share in the solder consumption sector, in new low-lead or no-lead solders.

The chemical industry is the second largest U.S. tin user. Tin chemicals are present in wood preservatives, stabilizers for making polyvinyl chlorides (PVC), and fungicides and biocides. Inorganic tin chemicals are used as reducing agents in the manufacture of perfume and soap stabilizers, and in the production of polyurethane.

Other important uses include tinning (mostly hot-dip coating of tin onto copper wire used in underground utility cables); brass/bronze (often used for electrical contacts and naval gear); pewter (often used for decorative items); and dental amalgams.

Tin is a relatively scarce element in Earth's crust. Principal deposits are scattered irregularly around the Pacific Rim, and about one-half of global supply comes from south Asia.

U.S. primary tin consumption was estimated to be about 33,000 metric tons in 2003, while tin imports to the United States were about 37,000 metric tons. Tin has long been one of the major components of the National Defense Stockpile, and disposals from the stockpile have taken place regularly since 1960, providing an important contribution to domestic tin supply. Although the United States has limited tin resources, scrap or recycled tin has been an important segment of domestic tin supply, accounting for about 20 percent of all tin used domestically.

In 2003, world tin mine production totaled 209,000 metric tons. Tin was mined in 20 countries, but the top 6 accounted for 93 percent of the world total, with Indonesia as the leading producer. World tin reserves were estimated to be 8 million metric tons. Assuming a world primary tin consumption of about 200,000 metric tons per year, these reserves would last 40 years at current rates of consumption.

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Sample of cassiterite, primary ore mineral for tin. Image from *Minerals in Your World*.