

**Chapter 3****SCIENCE & SOCIETY****● Minerals****Uses of Titanium**

Do you want a metal that is strong, light, and able to resist high temperatures, rust, and corrosion by seawater? Then you want titanium, and you're not alone. Titanium is a metal that is increasingly used in today's products because of these desirable features.

The ninth most plentiful element in Earth's crust, titanium was discovered by William Gregor (England) in 1791. It was not produced commercially, however, until 1948. Titanium is always produced from other minerals; most often from ilmenite and rutile. Ilmenite is found mainly in Australia, Canada, India, Norway, South Africa, and the United States. Rutile (found in beach sand) is found mainly in Australia, Brazil, Russia, Sierra Leone, and Sri Lanka. Manufacturers usually like to use rutile to make titanium metal because rutile has a large amount of titanium in it. It is also easier to make titanium metal from rutile. In addition, the process of separating titanium from rutile is less polluting.

Today, titanium metal and its alloys (titanium mixed with other metals) are used for many different purposes. Titanium's properties make it a logical choice to use in airplanes—especially in their engines. It is also used to make propeller blades and other parts for ships, because it does not corrode easily. Its strength and light weight make it ideal for use in spacecraft as well.

Titanium is often part of everyday life. Since titanium is nontoxic, it doesn't react with the human body. The metal is used in hip replacements, other artificial body parts, and surgical tools. It also can be used in dentures (it's thinner and has no metallic taste) and as anchors for artificial teeth. A titanium frame makes for a lightweight bicycle. Also, the flexibility in the

metal helps absorb the bumps and bounces a bicyclist experiences on a ride. In addition, titanium is now being used in softball bats.

Although the price is higher (\$350 for a bat made with titanium versus \$50–\$130 for a bat made with aluminum), batters can usually hit the ball farther using these bats. Titanium is even used in jewelry. This jewelry is not only unusual in color but it is also lightweight and does not cause allergic reactions in the wearer.

But, if titanium is such a desirable metal, why isn't it used in even more places? Right now, its biggest drawback is its cost. It is expensive to produce titanium from its ores. In certain industries, the expense can be justified. For example, if a spacecraft weighs one pound less using a lightweight material rather than another material, about \$20,000 can be saved over the life of the vehicle. If an airplane weighs one pound less, about \$200 will be saved over its lifetime. However, if an automobile weighs one pound less, it saves only about \$2 over its lifetime. More research will have to be done to try to lower the cost of the metal before it can be used in mass quantities.

Currently airplanes often use titanium in their engines because of its strength and resistance to high temperature, as well as its light weight. However, it could also be used in air frames (the "skeleton" of airplanes), skin (the outside covering of airplanes), and other airplane parts. Given the expense of titanium compared to other metals, is it worth increasing research to lower the cost of titanium in order to use it more in transportation vehicles? Or do you think it would be better to try to find other efficient methods to lower operating costs?

**You Decide**

1. Why isn't titanium used in more products, such as desk chairs?
2. Would you be willing to spend more money to buy a bicycle with a titanium frame? Explain.
3. Why do you think one less pound of weight in a spacecraft results in a savings of so much money?
4. Do you think more research should be done on the potential uses of titanium? Explain.