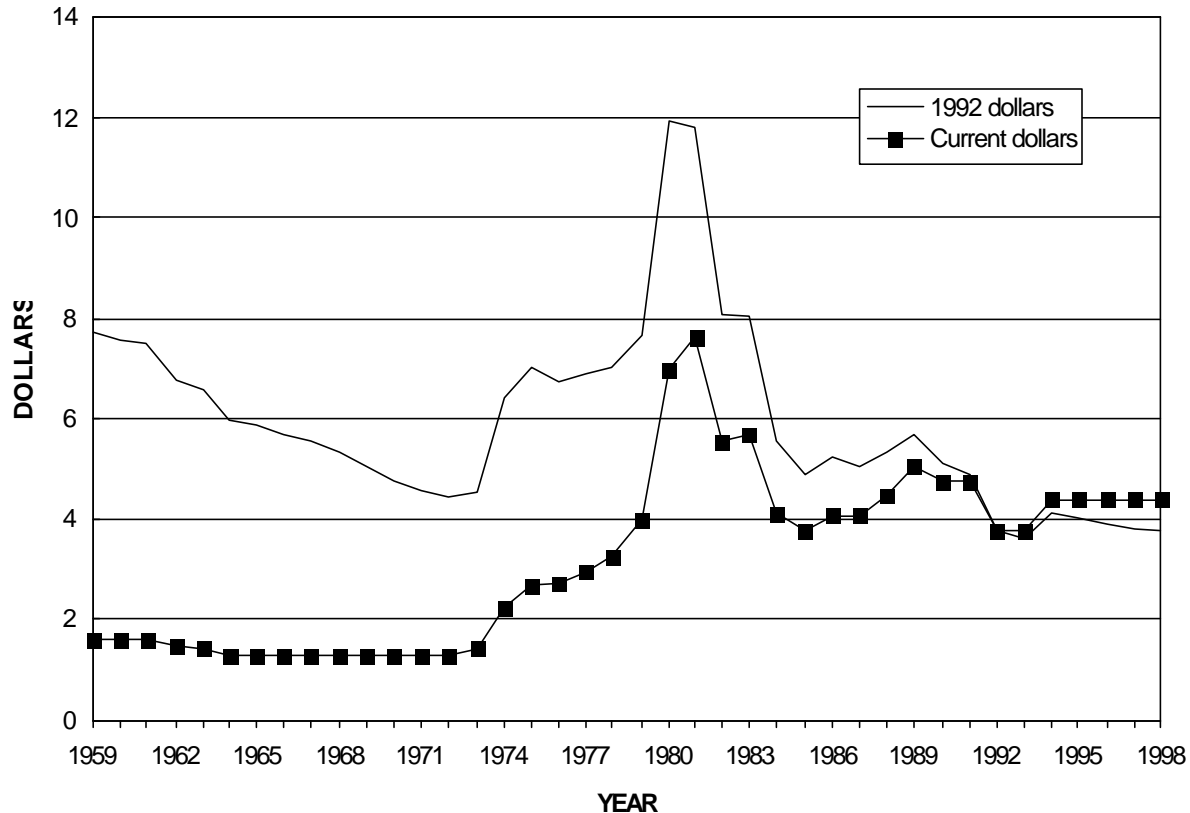


Average Yearend Titanium Sponge Price
(Dollars per pound)



Significant events affecting titanium prices since 1958

1971	Research for Supersonic Transport terminated
1975-76	Military aircraft production peak (F-14 and F-15)
1977-81	Rapid increase in orders for commercial aircraft
1982-84	Collapse of the commercial aircraft market
1984-86	Production of B1-B bombers
1985-89	Renewed strength in the commercial aircraft market
1988-89	Increases in U.S. sponge production capacity
1990-94	Reductions in military and commercial aerospace
1992	Sodium-reduction sponge plant closed at Ashtabula, OH
1993	Magnesium-reduction sponge plant commissioned at Henderson, NV
1994-97	Surge in consumer goods and commercial aerospace orders
1997-98	Cancellation of some commercial aircraft orders

Discovered in 1790, titanium is well known as a light metal with excellent corrosion resistance (Barksdale, 1966, p. 3).

Titanium sponge is the most basic form of titanium metal and can be produced from the minerals rutile, leucocoxene, and

ilmenite. Titanium metal is consumed primarily in the commercial and military aerospace industries. Large-scale production capacity of sponge exists in China, Japan, Kazakhstan, Russia, Ukraine, and the United States. Unlike some metals, titanium is not sold on any market exchanges. Although often unspecified, sponge prices are normally based on a minimum 93.3-percent titanium content with a Brinell hardness of less than 120.

Although commercial production of titanium pigments began in the early 1900's, commercially produced titanium metal was not available until 1948. During the first two decades of the commercial development of titanium metal, the price per pound declined significantly. Cancellation of the SST program in 1971 tended to keep demand and prices for titanium sponge low through 1973. From 1973 through 1981, however, prices rose along with generally increasing orders for commercial aircraft and other industrial uses. The historic high price in 1981 and the subsequent price collapse were believed to have been accentuated by an overestimation of aircraft orders that did not materialize or were later canceled as the aircraft market deteriorated, leaving some producers with large inventories of titanium metal products to be drawn from during a period of lower demand (National Materials Advisory Board, 1983, p. 7-22). From 1985 through 1989, titanium metal prices were again on the rise, reflecting renewed strength in the commercial aircraft and other industrial markets. Military aircraft programs, such as the B-1B bomber program, also contributed to the rise in demand during this period. Owing to this increased demand, two of the domestic sponge producers made moderate expansions to their existing capacity during 1988 and 1989 (Titanium Development Association, 1990, p. 3).

The early 1990's marked the end of the Cold War and the beginning of sharp cuts in defense spending. Concurrently, commercial aircraft and engine producers were reducing raw material inventory levels causing a significant fall in titanium metal demand and prices. Domestic consumption of titanium sponge fell by 42% in 1991.

Owing to decreased demand and the availability of imported material, RMI Titanium Co. closed its 10,900-metric-ton-per-year sponge production plant at Ashtabula, OH, in 1992 (RMI Titanium Co., 1992, p. 11). The closure left two remaining producers in the United States.

In 1993, Titanium Metals Corp. commissioned a 10,000-ton-per-year sponge plant at its Henderson, NV, facility. The expansion was based on a derivation of the Kroll process called Vacuum Distillation Process (VDP). According to industry reports, the new plant produced a higher quality sponge at lower operating costs. Following the commissioning of the VDP plant, much of the old Kroll plant capacity was idled (American Metal Market, 1993a).

Imports of titanium sponge rose sharply during the mid-1990's. Although it is not apparent from published prices of domestic sponge, imports were available at substantially less than the domestic published price (American Metal Market, 1993b). In 1994, the average unit value of imports reached a record low of \$1.58 per pound. A new use of titanium metal in golf club heads led to a resurgence in consumption for titanium in 1995 (American Metal Market, 1996). In addition, new commercial aircraft orders rose sharply from 1995 to 1997 (Aviation Week & Space Technology, 1997). By 1997, domestic consumption of titanium sponge reached a record high of 32,000 metric tons. Also in 1997, the total value of sponge imports reached a record high. According to U.S. Customs statistics, the average unit value of sponge imports was \$3.42 per pound.

The instabilities in Asian economies caused a cancellation of aircraft orders in 1998 (ISRI Commodities Report, 1998). These cancellations resulted in a moderate fall in consumption of titanium during 1998. Although prices for titanium metal products were also affected, long-term supply agreements between aircraft producers and titanium producers helped stabilize prices for some titanium products (Metal Bulletin, 1998).

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Average Yearend Titanium Sponge Price
(Dollars per pound¹)

Year	Price	Year	Price	Year	Price	Year	Price
1941	5.25	1956	2.75	1971	1.32	1986	4.10
1942	5.25	1957	2.25	1972	1.32	1987	4.10
1943	5.25	1958	1.82	1973	1.44	1988	4.50
1944	5.25	1959	1.60	1974	2.25	1989	5.05
1945	5.25	1960	1.60	1975	2.70	1990	4.75
1946	5.25	1961	1.60	1976	2.73	1991	4.75
1947	6.50	1962	1.46	1977	2.98	1992	3.75
1948	5.50	1963	1.44	1978	3.28	1993	3.75
1949	5.00	1964	1.32	1979	3.98	1994	4.38
1950	5.00	1965	1.32	1980	7.02	1995	4.38
1951	5.00	1966	1.32	1981	7.65	1996	4.38
1952	5.00	1967	1.32	1982	5.55	1997	4.38
1953	5.00	1968	1.32	1983	5.70	1998	4.38
1954	4.50	1969	1.32	1984	4.13		
1955	3.45	1970	1.32	1985	3.75		

¹ To convert to dollars per metric ton, multiply by 2,204.62.

Sources: E&MJ Metal and Mineral Markets (1941-51),(1952-65, 72-82), Metals Week (1967-71), American Metal Market (1983-98). Prices for the periods from 1952 through 1965 and 1972 through 1982 were published by the U.S. Bureau of Mines, but origin is unknown.