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2022 Minerals Yearbook

TANTALUM [ADVANCE RELEASE]

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Tantalum

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In 2022, U.S. tantalum apparent consumption (tantalum content) equaled 1,060 metric tons (t), an increase of 57% from that in 2021 (revised) (table 1). No domestic mine production of tantalum ore was reported. The estimated tantalum content of world mine production was 1,990 t, a 14% increase from world production in 2021 (revised) (tables 1, 4). The United States imported 1,720 t of tantalum contained in alloys, metals, ores and concentrates, and waste and scrap, 29% more than that in 2021 (revised). In the same period, the United States exported 662 t of tantalum contained in tantalum-bearing metal, alloys, ores and concentrates, and waste and scrap, compared with 655 t (revised) in 2021. Traded tantalum materials included chemicals, metal, potassium hepta-fluorotantalate (commercially known as K-salt), residue, scrap, slag, and tantalum ores and concentrates. The principal uses of tantalum were in electronic capacitors and in superalloys for aircraft engines and turbines.

K-salt and tantalum oxide (Ta_2O_5) do not have unique Harmonized Tariff Schedule of the United States (HTS) codes. As a result, a potentially significant part of tantalum material trade is undocumented.

Government Actions and Legislation

The United States is heavily reliant on imports of certain mineral commodities vital to the Nation's security and economic prosperity. According to Executive Order 13817, this dependency on foreign sources creates a strategic vulnerability for the U.S. economy and military owing to export restrictions, natural disasters, and other events that can disrupt the supply of critical minerals (Trump, 2017). In 2018, the U.S. Department of the Interior, in coordination with other executive branch agencies, published a list of 35 mineral commodities that were deemed critical (U.S. Department of the Interior, 2018). The list was developed to serve as an initial focus, pursuant to Executive Order 13817, "A Federal Strategy To Ensure Secure and Reliable Supplies of Critical Minerals" (Trump, 2017). In response to the Energy Act of 2020 (Public Law 116–260), the U.S. Department of the Interior (DOI) was directed to review and update a list of critical minerals at least every 3 years. A critical mineral is defined by the Energy Act of 2020 as a nonfuel mineral or mineral material essential to the economic or national security of the United States and which has a supply chain vulnerable to disruption. Critical minerals are also characterized as serving an essential function in the manufacturing of a product, the absence of which would have significant consequences for the economy or national security. On February 24, 2022, the U.S. Geological Survey (USGS) published the "2022 Final List of Critical Minerals" in the Federal Register (87 FR 10381). Compared with the prior list published in 2018, the 2022 list included 50 mineral commodities that included tantalum, compared with 35 mineral commodities or groups in the 2018 list and added nickel and zinc and removed helium, potash, rhenium, and strontium (U.S. Department of the Interior, 2022).

In 2022, the U.S. Department of Defense finalized the Defense Federal Acquisition Regulation Supplement to include tantalum as a "covered material" under 10 U.S.C. 2533c. With some exceptions, 10 U.S.C. 2533c prohibits commercial contracts and subcontracts from acquiring covered materials melted or produced in China, Iran, North Korea, or Russia, or any end-use item manufactured in these countries containing a covered material (U.S. Department of Defense, 2022).

Tantalum was first added to the U.S. Government stockpile in 1942 as tantalite ore, and the U.S. Congress designated tantalum as a strategic and critical material in 1946 by means of the Strategic and Critical Materials Stock Piling Act as amended through P.L. 79–520, July 23, 1946 (DeMille, 1947, p. 135, 479). The Defense Logistics Agency Strategic Materials, U.S. Department of Defense, designated less than 0.1 t of tantalum materials for potential disposal from the National Defense Stockpile under its fiscal year 2023 (October 1, 2022, through September 30, 2023) Annual Materials Plan. Tantalum was not included on the list of potential acquisitions (Defense Logistics Agency Strategic Materials, 2022a, b).

Production

Globally, tantalite and columbite-tantalite (also referred to as "coltan") were the leading minerals mined for tantalum. The primary marketable tantalum materials were tantalum metal (unwrought and wrought alloys, metal, and powder), ore, and scrap. Tantalum resources in the United States are low grade and mineralogically complex; most are not commercially recoverable at current (2022) prices. As a result, domestic supply has been a concern for many years. In 2022, no domestic tantalum mine production was reported. Recycled materials and stocks served as the only domestic supply sources of tantalum. Companies in the United States produced tantalum alloys, compounds, and metals from imported tantalum-containing materials and from foreign and domestic scrap. However, available information was inadequate to make reliable estimates of output (Project Blue Group Ltd., 2024b, p. 11).

Consumption

Domestic consumption data for tantalum materials were developed by the USGS by means of the "Columbium (Niobium) and Tantalum," "Consolidated Consumers," and "Specialty Ferroalloys" surveys. For tantalum materials, 1 consumer responded to the "Columbium (Niobium) and Tantalum" canvass, 12 responded to the "Consolidated Consumers" canvass, and none responded to the "Specialty Ferroalloys" canvass. Domestic consumption data for tantalum were withheld to avoid disclosing company proprietary data.

In October, Materion Corp. (Mayfield Heights, OH) announced a $20 million investment in its Newton, MA, facility to increase capacity for materials used in semiconductor chip manufacturing. In late 2021, Materion acquired H.C. Starck Electronic Materials (Newton, MA) from H.C. Starck Group GmbH (Germany). The acquisition offered Materion advanced manufacturing processes and technical capabilities for tantalum- and niobium-based products and services for aerospace, defense, industrial, and semiconductor industries. Materion owned 28 manufacturing facilities in 13 countries and produced beryllium and related alloys, coatings, compounds, and composites, as well as a variety of other engineered materials (Materion Corp., 2022, 2023).

Prices

Tantalum materials were not openly traded. Purchase contracts were confidential between buyer and seller; however, trade journals reported composite prices of tantalite based on interviews with buyers and sellers, and traders declared the value of tantalum materials that they imported or exported. In 2022, the annual average price of tantalite ore was $214 per kilogram of Ta_2O_5 content (table 1).

In 2022, the average unit value (gross weight basis) of tantalum materials imported to the United States was $375 per kilogram for metal and powders; $62 per kilogram for ores and concentrates, including synthetic concentrates; and $56 per kilogram for tantalum waste and scrap. The average unit value (gross weight basis) of exported tantalum materials was $500 per kilogram for metal (unwrought and wrought) and powder, $9 per kilogram for ores and concentrates, and $143 per kilogram for tantalum waste and scrap (table 2).

Foreign Trade

In 2022, according to the U.S. Census Bureau, the United States exported tantalum materials valued at $242 million, an increase of 19% from that in 2021 (revised), and imported tantalum materials valued at $374 million, an increase of 31% from that in 2021 (table 2). Traded tantalum materials included tantalum metal, ores and concentrates, and scrap. In 2022, Australia continued to be the leading supplier of tantalum ores and concentrates, accounting for 59% of imports (tables 2, 3). China was the leading supplier of tantalum metal powders and wrought metal, Germany was the leading supplier of unwrought tantalum metal, and Indonesia was the leading supplier of waste and scrap imports. In 2022, Mexico was the leading destination for United States exported synthetic concentrates, El Salvador was the leading destination for tantalum metal powders, Germany was the leading destination for exported unwrought tantalum metal, Kazakhstan was the leading destination of waste and scrap, and China was the leading destination for wrought products (table 2).

World Review

In 2022, world production of tantalum contained in cassiterite, columbite-tantalite, loparite, and tantalite concentrates was 1,990 t (tables 1, 4), 14% more than 1,750 t (revised) in 2021. Congo (Kinshasa), Brazil, and Rwanda were the leading producers of tantalum mineral concentrates, in descending order of quantity. In addition to production reported in the annual world production table, tantalum was available from tantalum-bearing tin slags, which are byproducts from tin smelting, principally from Asia and Brazil. In 2022, capacitors accounted for an estimated 39% of global tantalum consumption, followed by chemicals (21%), sputtering targets (16%), superalloys (11%), mill products (9%), and cemented carbides (4%) (Project Blue Group Ltd., 2024a, p. 7).

Australia.—Australian Strategic Materials Ltd. (ASM), a resource company developing the Dubbo Project in Toongi, New South Wales, announced that during the fiscal year ending June 30, 2022, it had completed the project's optimization study, submitted all licensing requests, and were waiting to receive approvals. The Dubbo Project contains hafnium, niobium, rare-earth elements (including yttrium), and zirconium resources. ASM intended to develop the project to produce oxides onsite for refining into critical metals at its metals plant in the Republic of Korea. According to the company's 2021 mineral resource estimate, total measured and indicated resources at the Dubbo Project were estimated to be 75 million metric tons (Mt) at 0.44% niobium oxide (Nb_2O_5) and 0.03% Ta_2O_5, supporting a potential 75-year mine life at an ore-processing rate of 1 million metric tons per year (Australian Strategic Materials Ltd., 2021, p. 17; Strategic Minerals Europe Corp., 2023, p. 4, 8, 12, 14, 17, 21).

In June 2022, Liontown Resources Ltd., a resource company developing its wholly owned Kathleen Valley lithium-tantalum project in Western Australia, announced that it had entered into a funding agreement of up to $300 million with a Ford Motor Company subsidiary to partially fund the project. The company's goal was to begin production of spodumene concentrate in September 2025. In 2021, Liontown Resources reported a proven and probable ore reserve estimate of 69 Mt with an average grade of 0.012% Ta_2O_5, containing approximately 6,800 t of tantalum (Liontown Resources Ltd., 2021, p. 9; 2024, p. 97).

Brazil.—Mineração Taboca S.A. [a subsidiary of MINSUR S.A. (Peru)] operated the Pitinga-Pirapora Mine complex in Amazonas State. In 2022, the company reported production of 4,008 t in gross weight of niobium and tantalum ferroalloys compared with 4,003 t in 2021 (MINSUR S.A., 2024, p. 15, 33, 81).

In December 2022, AMG Advanced Metallurgical Group N.V. (Netherlands) announced a partnership with JX Nippon Mining & Metals Corp. (Japan) and TANIOBIS GmbH (Germany). JX Nippon was expected to invest in expanding tantalum concentrate production from AMG's Mibra lithium-tantalum-niobium-tin mine in Minas Gerais State, and the resulting product was then intended to be sold to TANIOBIS (AMG Advanced Metallurgical Group N.V., 2022, p. 1; 2024, p. 135, 155). From 2019 through 2022, tantalum concentrate production from the Mibra Mine was not disclosed.

Spain.—In 2022, Strategic Minerals Europe Corp. (Canada) [formerly known as Buccaneer Gold Corp.] announced the transition of operations from using tailings to open pit mining at its Penouta Project. The Penouta Project, located in the Ourense Province of northwestern Spain, has a measured and indicated resource of 76.3 Mt containing 5,600 t of tantalum. In May, the company received Government approval for full development of the open pit mine for 30 years and permitted the mining

of cassiterite (a tin ore mineral), niobium, and tantalum, and industrial minerals such as feldspars, micas, and quartz. In 2022, Strategic Minerals produced 455 t of cassiterite concentrate with 70% tin content and 86 t of coltan concentrate, containing 23% tantalite and 25% columbite (Strategic Minerals Europe Corp., 2023, p. 3–5, 8).

Outlook

Tantalum is produced as a byproduct from many lithium hard-rock deposits, typically spodumene-bearing pegmatites. Global demand for lithium has increased significantly in recent years. As a result, several new hard-rock lithium mining operations, many in Australia, have started production, and these operations may become significant sources of tantalum as a byproduct. However, Africa, where tantalum is produced primarily at artisanal and small-scale mining operations, is expected to remain the leading tantalum-producing region in the near future.

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TABLE 1
SALIENT TANTALUM STATISTICS[1]

(Metric tons unless otherwise specified)

		2018	2019	2020	2021	2022
United States:						
Exports:						
Niobium ores and concentrates, gross weight		5	27	4	5	6
Synthetic ores and concentrates, gross weight		198	40	120	238	43
Tantalum ores and concentrates, gross weight		48	28	10	180	2
Tantalum-containing ores and concentrates,[2] tantalum (Ta) content[e]		95 [r]	30 [r]	53 [r]	146 [r]	19
Tantalum, unwrought, Ta content[3]		185	137	76	143	207
Tantalum, waste and scrap, Ta content[3]		305	145	138	190	224
Tantalum, wrought, Ta content[3]		124	115	168	176 [r]	212
Total exports, Ta content		708 [r]	427 [r]	434 [r]	655 [r]	662
Imports for consumption:						
Niobium ores and concentrates, gross weight		31	3	4	1	1
Synthetic ores and concentrates, gross weight		12	6	6	30	33
Tantalum ores and concentrates, gross weight		1,050	840	693	1,300	1,260
Tantalum-containing ores and concentrates,[2] Ta content[e]		288 [r]	223 [r]	185 [r]	354 [r]	345
Tantalum, unwrought, Ta content[3]		623	535	464	569	615
Tantalum, waste and scrap, Ta content[3]		608	508	489	348	690
Tantalum, wrought, Ta content[3]		96	79	65	57	70
Total imports, Ta content		1,620 [r]	1,350 [r]	1,200 [r]	1,330 [r]	1,720
Apparent consumption,[4] Ta content		907 [r]	918 [r]	768 [r]	673 [r]	1,060
Price, tantalite, Ta_2O_5 content[5]	dollars per kilogram	214	161	158	158	214
Value,[6] tantalum ores and concentrates, gross weight	do.	57	50	43	48	62
World, production of tantalum concentrates, Ta content[7]		2,000 [r]	1,760 [r]	1,910 [r]	1,750 [r]	1,990

[e]Estimated. [r]Revised. do. Ditto.

[1]Table includes data available through October 11, 2023. Data are rounded to no more than three significant digits, except "Value"; may not add to totals shown.

[2]Includes tantalum-containing ores and natural and synthetic tantalum-containing concentrates. Tantalum (Ta) content of ores and concentrates is estimated assuming the following tantalum oxide (Ta_2O_5) contents: 28% in niobium ore, 50% in synthetic concentrates, and 32% in tantalum ore. Ta_2O_5 is 81.897% Ta.

[3]Ta content estimated at 100%.

[4]Defined as imports minus exports.

[5]Average annual price per Ta_2O_5 content. Source: CRU Group (2018–21) and the Institute for Rare Earths and Metals (2022).

[6]Weighted average value of imported plus exported materials. Source: U.S. Census Bureau.

[7]May include estimated data.

TABLE 2
U.S. FOREIGN TRADE IN TANTALUM-CONTAINING ORES AND CONCENTRATES AND TANTALUM METAL AND ALLOYS, BY CLASS[1]

Trade code[2]	Class	2021 Gross weight (metric tons)	2021 Value (thousands)	2022 Gross weight (metric tons)	2022 Value (thousands)	Principal destinations and sources in 2022 (gross weight in metric tons and value in thousand dollars)
	Exports:					
2615.90.3000	Synthetic concentrates	238	$2,710 r	43	$130	Mexico 40, $90; Cambodia 2, $40.
2615.90.6030	Niobium ores and concentrates	5	149	6	166	India 5, $152.
2615.90.6060	Tantalum ores and concentrates	180	8,160	2	144	Belgium 2, $129.
8103.20.0030	Tantalum, unwrought, powders	84	31,100	97	28,500	El Salvador 55, $8,611; Japan 15, $7,536; Mexico 12, $5,040; Israel 6, $2,726.
8103.20.0090	Tantalum, unwrought, other	59	17,500	110	37,900	Germany 105, $35,930; Vietnam 2, $804; Mexico 2, $681.
8103.30.0000	Tantalum, waste and scrap	190	29,500	224	32,100	Kazakhstan 88, $18,583; Mexico 46, $3,233; United Kingdom 38, $4,574.
8103.90.0000	Tantalum, wrought	176 r	114,000	NA	NA	NA.
8103.91.0000	Crucibles of tantalum	NA	NA	2	1,160	Czechia 2, $872.
8103.99.0000	Articles of tantalum	NA	NA	210	142,000	China 104, $72,927; Republic of Korea 60, $38,881; Germany 22, $11,190.
	Total exports	932 r	203,000	694	242,000	
	Imports for consumption:					
2615.90.3000	Synthetic concentrates	30	931	33	903	Singapore 27, $863; Japan 2, $33.
2615.90.6030	Niobium ores and concentrates	1	85	1	43	China 1, $33.
2615.90.6060	Tantalum ores and concentrates	1,300	62,700	1,260	78,200	Australia 744, $45,008; United Arab Emirates 126, $7,608; Congo (Kinshasa) 109, $7,524.
8103.20.0030	Tantalum, unwrought, powders	195	64,300	189	76,800	China 92, $34,333; Germany 64, $27,465; Thailand 30, $13,925.
8103.20.0090	Tantalum, unwrought, other	375	107,000	426	138,000	Germany 159, $61,432; China 128, $36,779; Kazakhstan 83, $24,508.
8103.30.0000	Tantalum, waste and scrap	348	21,700	690	38,300	Indonesia 194, $5,165; Japan 78, $9,144; Republic of Korea 77, $2,959; Italy 72, $592.
8103.90.0000	Tantalum, wrought	57	29,200	NA	NA	NA.
8103.91.0000	Crucibles of tantalum	NA	NA	4	1,940	China 2, $831; Kazakhstan 1, $92.
8103.99.0000	Articles of tantalum	NA	NA	66	39,300	China 46, $25,058; Kazakhstan 10, $5,433; Austria 6, $5,318.
	Total imports	2,310	285,000	2,670	374,000	

rRevised. NA Not available.
[1]Table includes data available through May 11, 2023. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Exports categorized by Schedule B codes. Imports categorized by Harmonized Tariff Schedule of the United States codes.

Sources: U.S. Census Bureau; data adjusted by the U.S. Geological Survey.

TABLE 3

U.S. IMPORTS FOR CONSUMPTION OF TANTALUM ORES AND CONCENTRATES, BY COUNTRY OR LOCALITY[1, 2]

	2021		2022	
Country or locality	Gross weight (metric tons)	Value (thousands)	Gross weight (metric tons)	Value (thousands)
Australia	567	$27,500	744	$45,000
Belgium	--	--	46	3,150
Burundi	--	--	31	2,150
China	(3)	3	(3)	4
Congo (Kinshasa)	281	12,800	109	7,520
Czechia	11	398	--	--
Germany	(3)	52	(3)	5
Luxembourg	--	--	20	1,740
Mauritius	60	3,040	--	--
Mozambique	170	8,200	73	3,940
Reunion	10	359	--	--
Rwanda	37	1,750	93	5,780
Spain	--	--	6	367
Taiwan	--	--	1	212
Tanzania	93	5,180	12	742
United Arab Emirates	71	3,480	126	7,610
Total	1,300	62,700	1,260	78,200

-- Zero.

[1]Table includes data available through May 11, 2023. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Harmonized Tariff Schedule of the United States code 2615.90.6060.

[3]Less than ½ unit.

Sources: U.S. Census Bureau; data adjusted by the U.S. Geological Survey.

TABLE 4

TANTALUM: WORLD PRODUCTION OF MINERAL CONCENTRATES, BY COUNTRY OR LOCALITY[1, 2]

(Metric tons, tantalum content)

Country or locality[3]	2018	2019	2020	2021	2022
Australia, tantalite concentrate	32	67	42	44	46
Bolivia, tantalite concentrate	14	8	6 r	1	1 e
Brazil, mineral concentrate[e, 4]	360	440	470	360	370
Burundi, ore and concentrate[e]	43	38	30	39	58
China, mineral concentrate	90	76 e	74 e	76 e	78 e
Congo (Kinshasa):[e]					
Cassiterite concentrate	240	280	400	430	490
Columbite-tantalite concentrate	410 r	290	380	320 r	400
Total	650 r	570	780	750 r	890
Ethiopia, columbite-tantalite concentrate[e]	62	42	17	32	30
Mozambique, columbite-tantalite concentrate	30	27	43	37	25 e
Namibia, tantalite concentrate[e]	(5)	1	--	--	--
Nigeria, columbite-tantalite concentrate[e]	260	110	100 r	100 r	110
Russia, loparite concentrate	36	26	49	39 e	31 e
Rwanda:[e]					
Cassiterite concentrate	72	58	42	47	67
Columbite-tantalite concentrate	350	290	220	220 r	280
Total	422	348	262	267 r	347
Uganda, ore and concentrate[e]	1 r	2 r	38	7 r	7
Grand total	2,000 r	1,760 r	1,910 r	1,750 r	1,990

[e]Estimated. [r]Revised. -- Zero.

[1]Table includes data available through May 15, 2023. All data are reported unless otherwise noted, totals may include estimated data. Grand totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Figures for all countries represent marketable output.

[3]In addition to the countries and (or) localities listed, French Guiana may have produced tantalum mineral concentrates, but available information was inadequate to make reliable estimates of output.

[4]Includes columbite-tantalite and microlite.

[5]Less than ½ unit.