



2020 Minerals Yearbook

TANTALUM [ADVANCE RELEASE]

TANTALUM

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In 2020, U.S. tantalum apparent consumption (measured in tantalum content) equaled 814 metric tons (t), a decrease of 15% compared with that in 2019 (table 1). No domestic mine production of tantalum ore was reported. The estimated tantalum content of world mine production was 2,100 t, an 9% increase from revised world production in 2019 (tables 1, 4). The United States imported 1,230 t of tantalum contained in alloys, metals, ores and concentrates, and waste and scrap, 11% less than that in 2019 (table 1). In the same period, the United States exported 417 t of tantalum contained in tantalum-bearing metal, alloys, ores and concentrates, and waste and scrap, slightly less than that in 2019. 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.

Legislation and Government Programs

The United States is heavily reliant on imports of certain mineral commodities vital to the Nation's security and economic prosperity. On May 18, 2018, under Executive Order 13817, the U.S. Department of the Interior published a list of 35 critical mineral commodities that included tantalum. This dependency on foreign sources creates a strategic vulnerability for the U.S. economy and military to adverse foreign government action, natural disasters, and other events that can disrupt the supply of critical minerals (U.S. Department of the Interior, 2018).

On September 29, 2020, the U.S. Department of Defense revised section 849 of the National Defense Authorization Act for fiscal year 2020 to include tantalum in the definition of "covered materials" in 10 U.S.C. 2533c. With some exceptions, 10 U.S.C. 2533c prohibits commercial contracts and subcontracts in the acquisition of any covered material melted or produced in any covered country (China, Iran, North Korea, or Russia) or any end item manufactured in any covered country containing a covered material (U.S. Department of Defense, 2020).

Tantalum was first added to the U.S. Government stockpile in 1942 in the form of tantalite ore (DeMille, 1947, p. 479). The U.S. Department of Defense, Defense Logistics Agency Strategic Materials (DLA Strategic Materials), designated a maximum quantity of 1,710 kilograms (kg) of tantalum contained in tantalum carbide powder and 86 kg of tantalum scrap for disposal from the National Defense Stockpile under its Annual Materials Plan for fiscal year 2021 (October 1, 2020, to September 30, 2021) and designated a maximum quantity of 15,400 kg of tantalum for potential acquisition (Defense Logistics Agency Strategic Materials, 2020a, b). The disposal

of certain forms of tantalum was part of the DLA Strategic Materials' efforts to optimize the stockpile inventory in response to market conditions and national security needs. The stockpile inventory (tantalum content) as of December 30, 2020, was 1.5 kg of tantalum alloys, no stocks of tantalum carbide powder, 84 kg tantalum metal, and 18 kg of tantalum minerals and concentrate.

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, some are mineralogically complex, and most were not commercially recoverable at current prices. As a result, domestic supply has been a concern for many years. In 2020, no domestic tantalum mine production was reported. Recycled materials and stocks were the only domestic supply sources of tantalum. Companies in the United States produced tantalum alloys, compounds, and metal from imported tantalum-containing materials and from foreign and domestic scrap, but the available information was inadequate to make a reliable estimate of output. World tantalum resources and mining capacity were concentrated in Brazil, Congo (Kinshasa), Nigeria, and Rwanda. Current world tantalum reserves are adequate to meet anticipated global consumption through the next 10 years.

Consumption

Domestic consumption data for tantalum materials were developed by the U. S. Geological Survey by means of the "Columbium (Niobium) and Tantalum," "Consolidated Consumers," and "Specialty Ferroalloys" surveys. For tantalum materials, 1 responded to the "Columbium (Niobium) and Tantalum" canvass, 22 responded to the "Consolidated Consumers" canvass, and 1 responded to the "Specialty Ferroalloys" canvass.

U.S. apparent domestic consumption of tantalum totaled 814 t in 2020, a decrease of 15% compared with that in 2019. Imports of tantalum materials, including ores and concentrates, unwrought and wrought metal, and waste and scrap decreased in 2020 compared with the respective import quantities in 2019 (tables 1, 2).

In January, H.C. Starck Solutions acquired and installed an additive manufacturing system capable of three-dimensional (3D) printing metal parts from refractory alloys at its Coldwater, MI, facility (H.C. Starck Solutions, 2020). The system was developed by Renishaw plc, a United Kingdom-based engineering technologies company, and provided new design possibilities, minimized material use, and reduced tooling costs (Renishaw plc, 2020). With the new system,

H.C. Starck expected to optimize its processing of refractory alloys, including molybdenum, niobium, tantalum, and tungsten (H.C. Starck Solutions, 2020).

In June, Yageo Corp. (Taiwan) announced the completion of its acquisition of the U.S.-based tantalum capacitor producer KEMET Corp. (Fort Lauderdale, FL). In November 2019, Yageo Corp. had entered into a definitive agreement to acquire KEMET, which owned 23 manufacturing facilities in 22 countries and produced other high-end electronic components, including ceramic capacitors, film and electrolytic capacitors, and magnetic actuators and sensors (KEMET Corp., 2020).

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 2020, the annual average price of tantalite ore decreased to \$158 per kilogram of contained Ta₂O₅, slightly less than that in 2019 (table 1). The average monthly tantalite ore price was \$193 per kilogram of contained tantalum in January, where it remained through December (CRU Group, 2020).

Based on U.S. Census Bureau data, the average unit value (gross weight basis) of tantalum materials imported to the United States in 2020 was \$296 per kilogram for metal and powders; \$43 per kilogram for ore and concentrates, including synthetic concentrates; and \$45 per kilogram for tantalum waste and scrap. The average price of exported tantalum materials was \$560 per kilogram for metal (unwrought and wrought) and powder, \$21 per kilogram for ores and concentrates, and \$131 per kilogram for tantalum waste and scrap (table 2).

Foreign Trade

According to the U.S. Census Bureau, in 2020 the United States exported tantalum materials valued at \$157 million, essentially unchanged from that in 2019, and imported tantalum materials valued at \$209 million, a decrease of 19% compared with that in 2019 (table 2). Traded tantalum materials included tantalum metal, ores and concentrates, and scrap. In 2020, Australia continued to be the leading supplier of tantalum ores and concentrates, accounting for more than one-half of imports (table 3). China was the leading supplier of tantalum metal (wrought and unwrought) and replaced Indonesia as the leading supplier of waste and scrap imports. Germany continued to be the leading supplier of tantalum metal powders. In 2020, Estonia was the leading destination of United States exported synthetic concentrates and El Salvador was the leading destination of tantalum metal powders. The United Kingdom was the leading destination of exported unwrought tantalum metal and waste and scrap were predominantly exported to Kazakhstan. China continued to be the leading destination for wrought products (table 2).

World Review

In 2020, world production of tantalum contained in cassiterite, columbite-tantalite, loparite, and tantalite concentrates was

estimated to be 2,100 t (table 4), a 9% increase compared with 1,920 t in 2019. Congo (Kinshasa), Brazil, and Rwanda were the leading producers of tantalum mineral concentrates, in descending order of quantity. Tantalum-bearing tin slags, which are byproducts from tin smelting, principally from Asia and Brazil, were another source of tantalum. In 2020, capacitors accounted for an estimated 41% of global tantalum consumption, followed by chemicals (19%), sputtering targets (17%), superalloys (11%), mill products (8%), and cemented carbides (4%) (Roskill Information Services Ltd., 2020, p. 5).

European Union.—In March, the European Commission (2020) published a revised fourth list of 30 critical raw materials. The European Union (EU) Regulation on Conflict Minerals, covering tin, gold, and the critical raw materials tantalum and tungsten, would apply to EU importers as of January 1, 2021. The law would compel mines into complying with EU regulations and the Organisation for Economic Co-operation and Development's (OECD's) due diligence guidance. It would ensure that smelters source their materials responsibly and is expected to reduce trade that financed conflict and the illegal exploitation of minerals, workers, and communities.

Australia.—Liontown Resources Ltd. reported updated measured, indicated, and inferred resources of 156 million metric tons (Mt) with an average grade of 0.013% Ta₂O₅ for its wholly owned Kathleen Valley lithium-tantalum project in the State of Western Australia. The update more than doubled the 2019 mineral resource estimate of 74.9 Mt (Liontown Resources Ltd., 2020, p. 8).

In October 2020, Pilbara Minerals Ltd. announced its total Ta₂O₅ production for the year ending June 30, 2020, equaled 39 t, a 52% decrease compared with 82 t in 2019 (Pilbara Minerals Ltd., 2019, p. 14; 2020, p. 2). In 2019, Pilbara Minerals Ltd. decreased production at the Pilgangoora lithium-tantalum mine in the State of Western Australia owing to declining demand for lithium raw materials, particularly in China. The company offset the lower production with increased shipments from its existing stockpiles (Pilbara Minerals Ltd., 2020, p. 74). In December 2020, Pilbara Minerals reported improved market conditions and expanded operations from moderated to full production (Pilbara Minerals Ltd., 2021, p. 82).

Brazil.—Mineração Taboca S.A. [a subsidiary of MINSUR S.A. (Peru)] operated the Pitinga-Pirapora Mine complex in Amazonas State. In 2020, the company reported production of 3,480 t in gross weight of niobium and tantalum ferroalloys with an average combined niobium and tantalum content of 47%, an 11% decrease compared with total ferroalloy production in 2019. MINSUR reported that the production decrease was due to the impacts from the global coronavirus disease 2019 (COVID-19) pandemic throughout the year, resulting in operational stoppages and a reduction of labor (MINSUR S.A., 2020, p. 30).

AMG Advanced Metallurgical Group N.V. (Netherlands) did not disclose tantalum concentrates production amounts at its Mibra lithium-tantalum-niobium-tin mine in Minas Gerais State for 2019 and 2020.

China.—Yanling Jincheng Tantalum & Niobium Co. Ltd. planned to increase tantalum metal ingot capacity by installing four additional furnaces at its facility in Zhejiang Province.

The expansion project was expected to double the company's tantalum metal capacity to 600 t/yr from 300 t/yr and be completed by yearend 2020 (Argus Metals International, 2020a).

A new tantalum and niobium production project was in development by China's Yanling county government and Changsha Nanfang Tantalum Niobium Co., Ltd. in southern Hunan Province. The first phase was expected to conclude in early 2021 and have a capacity of 100 t/yr of tantalum and niobium bar (Argus Metals International, 2020b).

In August, Jiangxi Sanshi Nonferrous Metal Co., Ltd. announced plans to start production at its new tantalum and niobium oxides plant in June 2021. The facility expected to have a capacity of 210 t/yr of Ta₂O₅, 610 t/yr of niobium oxide (Nb₂O₅), and 220 t/yr of K-salt (Argus Metals International, 2020c).

Namibia.—In June, Kazera Global Investments plc (formerly known as Kennedy Ventures) announced that it now held a 100% stake in African Tantalum Pty. Ltd (Aftan) after acquiring the remaining 25% from Warmbad Investment Holdings. Aftan was the operator of the Tantalite Valley Tantalum Mine in southeastern Namibia. Commercial mine production had yet to be achieved owing to the lack of a consistent water source needed for continuous production. The company intended to run a 17-kilometer pipeline from the Orange River to solve this problem. The site had certified several shipments for sale as a nonconflict source to its customers (Align Research Ltd., 2020, p. 2, 12).

Russia.—LLC Lovozero GOK operated the Lovozero Mine in the Murmansk region. The company produced loparite mineral concentrates consumed by the JSC Solikamsk Magnesium Works (SMZ) facility to produce tantalum compounds in Perm Kray. In 2020, SMZ reported 60 t of Ta₂O₅ content in shipments of tantalum compounds, almost double compared with 32 t in 2019. More than 40% of the shipments were sent to consumers in Asia, with most of the remaining sent to Europe and The Eurasian Economic Union (JSC Solikamsk Magnesium Works, 2020, p. 12–15).

Outlook

Tantalum is a byproduct of lithium production from many hard-rock lithium 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 still expected to remain the leading tantalum-producing region in the near future.

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TABLE 1
 SALIENT TANTALUM STATISTICS¹

(Metric tons unless otherwise specified)

	2016	2017	2018	2019	2020
United States:					
Exports:					
Niobium ores and concentrates, gross weight	14	7	5	27	4
Synthetic ores and concentrates, gross weight	379	113	198	40	120
Tantalum ores and concentrates, gross weight	162	109	48	28	10
Tantalum-containing ores and concentrates, ² Ta content ^c	152	65	68	26	36
Tantalum, unwrought, Ta content ³	223	220	185	137	76
Tantalum, waste and scrap, Ta content ³	171	169	305	145	138
Tantalum, wrought, Ta content ³	58	95	124	115	168
Total exports, Ta content	604	549	681	423	417
Imports for consumption:					
Niobium ores and concentrates, gross weight	1	1	31	3	4
Synthetic ores and concentrates, gross weight	9	15	12	6	6
Tantalum ores and concentrates, gross weight	675	1,010	1,050	840	693
Tantalum-containing ores and concentrates, ² Ta content ^c	207	311	330	257	213
Tantalum, unwrought, Ta content ³	320	484	623 ^r	535 ^r	464
Tantalum, waste and scrap, Ta content ³	489	586	608	508 ^r	489
Tantalum, wrought, Ta content ³	48	74	96 ^r	79 ^r	65
Total imports, Ta content	1,060	1,460	1,660	1,380	1,230
Apparent consumption, ⁴ Ta content	459 ^r	907	975	956 ^r	814
Price, tantalite, ⁵ Ta ₂ O ₅ content dollars per kilogram	193	193	214	161	158
Value, ⁶ tantalum ores and concentrates, gross weight do.	53	39	57	50	43
World, production of tantalum concentrates, Ta content ⁷	1,680	1,910	2,100 ^r	1,920 ^r	2,100

^cEstimated. ^rRevised. do. Ditto.

¹Table includes data available through August 4, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes natural and synthetic tantalum-containing ores and concentrates. Tantalum (Ta) content of ores and concentrates is estimated assuming the following tantalum oxide (Ta₂O₅) contents: 32% in niobium ore, 32% in synthetic concentrates, and 37% in tantalum ore. Ta₂O₅ is 81.897% Ta.

³Tantalum content estimated at 100%.

⁴Defined as imports minus exports.

⁵Average annual price per Ta₂O₅ content as reported by CRU Group.

⁶Weighted average value of imported plus exported materials.

⁷May include estimated data.

TABLE 2
U.S. FOREIGN TRADE IN TANTALUM-CONTAINING ORE AND CONCENTRATES AND TANTALUM METAL AND ALLOYS, BY CLASS¹

HTS ² code or Schedule B number	Class	2019		2020		Principal destinations and sources in 2020 (gross weight in kilograms and values in thousand dollars)
		Gross weight (kilograms)	Value (thousands)	Gross weight (kilograms)	Value (thousands)	
Exports:						
2615.90.3000	Synthetic concentrates	40,100	\$975	120,000	\$2,110	Estonia 95,400, \$798; Germany 23,300, \$1,290.
2615.90.6030	Niobium ores and concentrates	26,900	163	4,380	126	India 2,870, \$83; China 1,090, \$31.
2615.90.6060	Tantalum ores and concentrates	27,800	168	9,690	525	Austria 7,430, \$443; Netherlands 2,000, \$66.
8103.20.0030	Tantalum, unwrought, powders	113,000	45,600	68,700	28,500	El Salvador 28,600, \$10,100; Mexico 16,800, \$6,960; Israel 10,700, \$5,160.
8103.20.0090	Tantalum, unwrought, other	24,300	9,180	7,370	2,070	United Kingdom 5,740, \$1,260; Mexico 1,130, \$592.
8103.30.0000	Tantalum, waste and scrap	145,000	17,600	138,000	18,100	Kazakhstan 65,000, \$9,070; Germany 26,900, \$1,890; Japan 16,200, \$1,960.
8103.90.0000	Tantalum, wrought	115,000	83,700	168,000	106,000	China 73,300, \$48,200; Republic of Korea 36,400, \$28,000; Germany 25,400, \$10,300.
Total exports		492,000	157,000	516,000	157,000	
Imports for consumption:						
2615.90.3000	Synthetic concentrates	5,810	31	6,280	199	Singapore 4,620, \$149; Canada 1,660, \$50.
2615.90.6030	Niobium ores and concentrates	3,370	179	4,000	97	Canada 1,730, \$23; Belgium 1,650, \$18.
2615.90.6060	Tantalum ores and concentrates	840,000	43,100	693,000	29,800	Australia 499,000, \$20,300; Mauritius 105,000, \$5,740; Congo (Kinshasa) 89,000, \$3,720.
8103.20.0030	Tantalum, unwrought, powders	259,000	74,200	189,000	55,700	Germany 86,200, \$25,900; China 60,200, \$16,600; Thailand 39,500, \$12,600.
8103.20.0090	Tantalum, unwrought, other	276,000 ^r	78,800 ^r	275,000	71,700	China 141,000, \$34,000; Kazakhstan 54,700, \$15,200; Germany 34,700, \$14,200.
8103.30.0000	Tantalum, waste and scrap	508,000 ^r	27,900 ^r	489,000	22,100	China 143,000, \$5,370; Indonesia 114,000, \$2,520; Japan 87,400, \$4,000.
8103.90.0000	Tantalum, wrought	79,100 ^r	33,600 ^r	65,200 ^r	29,400	China 27,800, \$12,400; Kazakhstan 22,200, \$5,190.
Total imports		1,970,000	258,000	1,720,000	209,000	

^rRevised.

¹Table includes data available through July 29, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

²Harmonized Tariff Schedule of the United States.

Sources: U.S. Census Bureau and U.S. Geological Survey.

TABLE 3
U.S IMPORTS FOR CONSUMPTION OF TANTALUM ORES AND CONCENTRATES, BY COUNTRY OR LOCALITY^{1,2}

Country or locality	2019		2020	
	Gross weight (kilograms)	Value (thousands)	Gross weight (kilograms)	Value (thousands)
Australia	454,000	\$21,500	499,000	\$20,300
China	61	14	6	4
Congo (Kinshasa)	--	--	89,000	3,720
Macau	15,000	789	--	--
Mauritius	13,600	927	105,000	5,740
Mozambique	46,800	3,650	--	--
Rwanda	238,000	14,200	--	--
United Arab Emirates	73,100	2,080	--	--
Total	840,000	43,100	693,000	29,800

-- Zero.

¹Table includes data available through July 29, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

²Harmonized Tariff Schedule of the United States code 2615.90.6060.

Sources: U.S. Census Bureau and U.S. Geological Survey.

TABLE 4
TANTALUM: WORLD PRODUCTION OF MINERAL CONCENTRATES, BY COUNTRY OR LOCALITY^{1,2}

(Kilograms, tantalum content)

Country or locality ³	2016	2017	2018	2019	2020
Australia, tantalite concentrate	11,000	20,000	32,000	67,000	34,000
Bolivia, tantalite concentrate	--	2,100	14,400	7,900 ^r	6,500
Brazil, mineral concentrate ⁴	234,000	270,000	360,000 ^e	440,000 ^{r,e}	470,000 ^e
Burundi, ore and concentrate ^e	6,200	28,000	43,000	38,000	24,000
China, mineral concentrate	65,000	75,000	90,000	76,000 ^e	74,000 ^e
Congo (Kinshasa): ^e					
Cassiterite concentrate	180,000	280,000	240,000	280,000 ^r	400,000
Columbite-tantalite concentrate	530,000	480,000	500,000	290,000 ^r	380,000
Total	710,000	760,000	740,000	570,000 ^r	780,000
Ethiopia, columbite-tantalite concentrate ^e	63,000	65,000	70,000	70,000	69,000
Mozambique, columbite-tantalite concentrate	18,767	26,000	30,000	27,000 ^r	43,000
Namibia, tantalite concentrate	430 ^e	2,200 ^e	330 ^e	500 ^{r,e}	--
Nigeria, columbite-tantalite concentrate ^e	210,000	180,000	260,000 ^r	260,000 ^r	260,000
Russia, loparite concentrate	39,966	36,444	36,200	25,900	49,000
Rwanda:					
Cassiterite concentrate	53,000	71,000	71,000	56,000	35,000
Columbite-tantalite concentrate ^e	270,000	370,000	350,000	280,000	219,000
Total ^e	323,000	441,000	421,000	336,000	254,000
Uganda, ore and concentrate ^e	2,800	2,500	1,500 ^r	1,500 ^r	38,000
Grand total	1,680,000	1,910,000	2,100,000 ^r	1,920,000 ^r	2,100,000

^eEstimated. ^rRevised. -- Zero.

¹Table includes data available through October 4, 2021. 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.

²Figures for all countries represent marketable output.

³In 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.

⁴Includes columbite-tantalite and microlite.