

# GRAPHITE (NATURAL)

(Data in metric tons unless otherwise noted)

**Domestic Production and Use:** In 2020, natural graphite was not produced in the United States; however, approximately 95 U.S. firms, primarily in the Great Lakes and Northeastern regions and Alabama and Tennessee, consumed 35,000 tons valued at an estimated \$21 million. The major uses of natural graphite were batteries, brake linings, lubricants, powdered metals, refractory applications, and steelmaking. During 2020, U.S. natural graphite imports were an estimated 41,000 tons, which were about 71% flake and high-purity, 28% amorphous, and 1% lump and chip graphite.

<b>Salient Statistics—United States:</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020<sup>e</sup></b>
Production, mine	—	—	—	—	—
Imports for consumption	38,900	51,900	70,700	50,300	41,000
Exports	14,300	13,900	9,950	5,880	5,600
Consumption, apparent <sup>1</sup>	24,700	38,000	60,800	44,400	35,000
Price, imports (average dollars per ton at foreign ports):					
Flake	1,920	1,390	1,520	1,350	1,400
Lump and chip (Sri Lanka)	1,880	1,900	1,890	2,390	3,400
Amorphous	571	451	319	496	570
Net import reliance <sup>1</sup> as a percentage of apparent consumption	100	100	100	100	100

**Recycling:** Refractory brick and linings, alumina-graphite refractories for continuous metal castings, magnesia-graphite refractory brick for basic oxygen and electric arc furnaces, and insulation brick led the way in the recycling of graphite products. The market for recycled refractory graphite material is expanding, with material being recycled into products such as brake linings and thermal insulation. Recovering high-quality flake graphite from steelmaking kish is technically feasible, but currently not practiced. The abundance of graphite in the world market inhibits increased recycling efforts. Information on the quantity and value of recycled graphite is not available.

**Import Sources (2016–19):** China, 33%; Mexico, 23%; Canada, 17%; India, 9%; and other, 18%.

<b>Tariff:</b>	<b>Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–20</b>
	Crystalline flake (not including flake dust)	2504.10.1000	Free.
	Powder	2504.10.5000	Free.
	Other	2504.90.0000	Free.

**Depletion Allowance:** 22% (domestic lump and amorphous), 14% (domestic flake), and 14% (foreign).

**Government Stockpile:** None.

**Events, Trends, and Issues:** U.S. natural graphite exports decreased each year from 2016 to 2020, with an overall 61% decline over the 5-year period. U.S. imports for consumption and apparent consumption increased each year from 2016 to 2018, when imports and consumption peaked, and declined each year during 2019 and 2020. Restrictions put in place in response to the COVID-19 pandemic caused the 2020 U.S. imports to decrease by 18%, which in turn caused a 21% decrease in U.S. apparent consumption.

In 2020, principal United States import sources of natural graphite were, in descending order of tonnage, China, Mexico, Canada, Madagascar, Mozambique, Brazil, the United Kingdom, Hong Kong, Austria, and Belgium, which combined accounted for 99% of the tonnage and 96% of the value of total United States imports. China and Mexico provided most of the amorphous graphite, and Sri Lanka provided all the lump and chip dust variety.

During 2020, China was the world's leading graphite producer, producing an estimated 62% of total world output. Approximately 40% of production in China was amorphous graphite and about 60% was flake. China produced some large flake graphite, but much of its flake graphite production is very small, in the +200-mesh range. China also processed most of the world's spherical graphite. Globally, during the first 6 months of 2020, the COVID-19 pandemic had some effect on graphite supplies, but mostly to operations outside of China. Most areas in China important for natural graphite flake production were far from the initial coronavirus occurrences. The impact was limited in these areas and the recovery was quick, which was demonstrated by China's pattern of exports. Chinese producers quickly increased production after a few months of closures in 2020. This allowed China to gain a more dominant position in the market and slow down the diversification of the supply chain.

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North America produced only 2% of the world's graphite supply with production in Canada and Mexico. No production of natural graphite was reported in the United States, but two companies were developing graphite projects—one in Alabama and one in Alaska.

Large graphite deposits were being developed in Madagascar, northern Mozambique, Namibia, and south-central Tanzania. A graphite mine in Mozambique in a high-grade graphite deposit was reportedly the largest natural graphite mine globally. The mine was expected to operate for about 50 years.

A U.S. automaker continued building a large plant to manufacture lithium-ion electric vehicle batteries. The automaker reported that the plant was about 30% completed. The completed portion of the plant was operational, and it produced battery cells, battery packs, drive units, and energy storage products. At full capacity, the plant was expected to require 35,200 tons per year of spherical graphite for use as anode material for lithium-ion batteries.

New thermal technology and acid-leaching techniques have enabled the production of higher purity graphite powders that are likely to lead to development of new applications for graphite in high-technology fields. Innovative refining techniques have made the use of graphite possible in carbon-graphite composites, electronics, foils, friction materials, and specialty lubricant applications. Flexible graphite product lines are likely to be the fastest growing market. Large-scale fuel-cell applications are being developed that could consume as much graphite as all other uses combined.

**World Mine Production and Reserves:** Reserves for Brazil, Madagascar, Sri Lanka, and Tanzania were revised based on information reported by graphite-producing companies and the Governments of those countries.

	<b>Mine production</b>		<b>Reserves<sup>2</sup></b>
	<b><u>2019</u></b>	<b><u>2020<sup>e</sup></u></b>	
United States	—	—	(3)
Austria	1,000	1,000	(3)
Brazil	96,000	95,000	70,000,000
Canada	11,000	10,000	(3)
China	700,000	650,000	73,000,000
Germany	800	800	(3)
India	35,000	34,000	8,000,000
Korea, North	6,000	5,000	2,000,000
Madagascar	48,000	47,000	26,000,000
Mexico	9,000	8,000	3,100,000
Mozambique	107,000	120,000	25,000,000
Norway	16,000	15,000	600,000
Pakistan	14,000	13,000	(3)
Russia	25,100	24,000	(3)
Sri Lanka	4,000	3,500	1,500,000
Tanzania	150	150	17,000,000
Turkey	2,000	1,500	90,000,000
Ukraine	20,000	19,000	(3)
Uzbekistan	100	100	7,600,000
Vietnam	5,000	4,500	(3)
World total (rounded)	<u>1,100,000</u>	<u>1,100,000</u>	<u>320,000,000</u>

**World Resources:**<sup>2</sup> Domestic resources of graphite are relatively small, but the rest of the world's inferred resources exceed 800 million tons of recoverable graphite.

**Substitutes:** Synthetic graphite powder, scrap from discarded machined shapes, and calcined petroleum coke compete for use in iron and steel production. Synthetic graphite powder and secondary synthetic graphite from machining graphite shapes compete for use in battery applications. Finely ground coke with olivine is a potential competitor in foundry-facing applications. Molybdenum disulfide competes as a dry lubricant but is more sensitive to oxidizing conditions.

<sup>e</sup>Estimated. — Zero.

<sup>1</sup>Defined as imports – exports.

<sup>2</sup>See Appendix C for resource and reserve definitions and information concerning data sources.

<sup>3</sup>Included with "World total."