

GRAPHITE (NATURAL)

(Data in metric tons unless otherwise noted)

Domestic Production and Use: Although natural graphite was not produced in the United States in 2018, approximately 95 U.S. firms, primarily in the Great Lakes and Northeastern regions and Alabama and Tennessee, consumed 40,000 tons valued at an estimated \$37 million. The major uses of natural graphite in 2018 were brake linings, lubricants, powdered metals, refractory applications, and steelmaking. During 2018, U.S. natural graphite imports were 52,000 tons, which were about 75% flake and high-purity, 24% amorphous, and 1% lump and chip graphite.

Salient Statistics—United States:	2014	2015	2016	2017	2018^e
Production, mine	—	—	—	—	—
Imports for consumption	69,600	46,700	38,900	51,900	52,000
Exports	12,200	11,600	14,300	13,900	12,000
Consumption, apparent ¹	57,400	35,100	24,700	38,000	40,000
Price, imports (average dollars per ton at foreign ports):					
Flake	1,270	1,710	1,920	1,390	1,480
Lump and chip (Sri Lankan)	1,870	1,800	1,880	1,900	1,840
Amorphous	360	454	571	451	426
Net import reliance ¹ 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 (2014–17): China, 37%; Mexico, 29%; Canada, 17%; Brazil, 9%; and other, 8%.

Tariff:	Item	Number	Normal Trade Relations 12–31–18
	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: Worldwide consumption of graphite has steadily increased since 2013 and into 2018. U.S. consumption of natural graphite was at its highest point during the past 5 years in 2014. During 2015, U.S. consumption declined by 39% and continued declining into 2016; however, during 2017 and 2018, consumption increased by 54% and 5%, respectively.

In 2018, principal United States import sources of natural graphite were, in descending order of tonnage, China, Mexico, Canada, Brazil, Madagascar, Hong Kong, Sri Lanka, the United Kingdom, and Japan, which combined accounted for 99% of the tonnage and 98% of the value of total United States imports. Mexico provided most of the amorphous graphite, and Sri Lanka provided all the lump and chip dust variety.

During 2018, China produced 70% of the world's graphite. Approximately 44% of production in China was amorphous graphite and about 56% was flake. China does produce some large flake graphite, but the majority of its flake graphite production is very small, in the +200-mesh range.

New graphite deposits were being developed in Madagascar, Mozambique, Namibia, and Tanzania, and mines were projected to begin production in the near future. During 2017, some of the mines in Tanzania began sampling production. A graphite mine project in Mozambique commenced operations at the start of 2018 and was ramping up production at a high-grade graphite deposit. Reportedly the largest natural graphite mine globally, it is expected to operate for 50 years.

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North America produced only 5% 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.

A U.S. automaker was building a large plant to manufacture lithium-ion electric vehicle batteries. The plant's completion was projected for 2020. A portion of the plant was operational and battery packs were being assembled in 2018. When the plant is complete, it 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.

In May 2018, the U.S. Department of the Interior, in coordination with other executive branch agencies, published a list of 35 critical minerals (83 FR 23295), including graphite. This 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" (82 FR 60835).

World Mine Production and Reserves: The reserves data for Brazil, China, North Korea, Norway, and Vietnam were revised based on information reported by graphite-producing companies and the Governments of those countries.

	Mine production		Reserves ²
	2017	2018 ^e	
United States	—	—	(³)
Brazil	90,000	95,000	72,000,000
Canada	40,000	40,000	(³)
China	625,000	630,000	73,000,000
India	35,000	35,000	8,000,000
Korea, North	5,500	6,000	2,000,000
Madagascar	9,000	9,000	1,600,000
Mexico	9,000	9,000	3,100,000
Mozambique	300	20,000	17,000,000
Namibia	2,220	2,200	(³)
Norway	15,500	16,000	600,000
Pakistan	14,000	14,000	(³)
Russia	17,000	17,000	(³)
Sri Lanka	3,500	4,000	(³)
Tanzania	—	—	17,000,000
Turkey	2,300	2,000	90,000,000
Ukraine	20,000	20,000	(³)
Vietnam	5,000	5,000	7,600,000
Zimbabwe	1,580	2,000	(³)
Other	1,900	4,000	(³)
World total (rounded)	897,000	930,000	300,000,000

World Resources: 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.

^eEstimated. — Zero.

¹Defined as imports – exports.

²See Appendix C for resource and reserve definitions and information concerning data sources.

³Included with "World total."