GRAPHITE (NATURAL)

(Data in thousand metric tons unless otherwise noted)

Domestic Production and Use: Although natural graphite was not produced in the United States in 2017, approximately 95 U.S. firms, primarily in the Great Lakes and Northeastern regions and Alabama and Tennessee, consumed 24,000 tons valued at $42.9 million. The major uses of natural graphite in 2017 were brake linings, lubricants, powdered metals, refractory applications, and steelmaking. During 2017, U.S. natural graphite imports were 50,000 tons, which were 75% flake and high-purity, 24% amorphous, and 1% lump and chip graphite.

Salient Statistics—United States:	2013	2014	2015	2016	2017[e]
Production, mine	—	—	—	—	—
Imports for consumption	61	70	47	39	50
Exports	10	12	12	14	26
Consumption, apparent[1]	51	57	35	25	24
Price, imports (average dollars per ton at foreign ports):					
Flake	1,330	1,270	1,710	1,460	1,400
Lump and chip (Sri Lankan)	1,720	1,870	1,800	1,880	1,840
Amorphous	375	360	454	509	392
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 not practiced at the present time. 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 (2013–16): China, 35%; Mexico, 31%; Canada, 17%; Brazil, 8%; and other, 9%.

Tariff: Item	Number	Normal Trade Relations 12–31–17
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 steadily increased since 2013 and into 2017. This increase resulted from the improvement of global economic conditions and its impact on industries that use graphite; however, U.S. consumption of natural graphite has declined since 2014.

In 2017, principal U.S. import sources of natural graphite were, in descending order of tonnage, China, Mexico, Canada, Brazil, and Madagascar, which combined accounted for 99% of the tonnage and 94% of the value of total imports. Mexico provided all the amorphous graphite, and Sri Lanka provided all the lump and chip dust variety. China, Canada, Brazil, and Madagascar were, in descending order of tonnage, the major suppliers of crystalline flake and flake dust graphite.

During 2017, China produced 67% of the world's graphite. Approximately 70% of production in China is amorphous graphite and about 30% is flake. China does produce some large flake graphite, but the majority of its flake graphite production is very small, in the +200 mesh range.

Graphite production decreased in Madagascar and increased in Mexico and North Korea from that of 2016. New deposits are being developed in Madagascar, Mozambique, Namibia, and Tanzania, and mines are projected to begin production in the near future. During 2017, some of the mines in Mozambique and Tanzania began producing graphite.

Prepared by **Donald W. Olson [(703) 648–7721, dolson@usgs.gov]**

GRAPHITE (NATURAL)

North America produced only 3% 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 in the United States. Alabama Graphite Corp. was developing the Coosa Graphite Project in Alabama, and Graphite One Resources Inc. was developing the Graphite Creek Project in Alaska.

One U.S. automaker was building a large plant to manufacture lithium-ion electric vehicle batteries. The plant's completion was originally projected for 2020, but the project is about 2 years ahead of schedule. During July 2016, one-sixth of the plant was completed, and the first batteries were produced in January 2017. When the plant is complete, it will require 93,000 tons of flake graphite to produce 35,200 tons of spherical graphite for use as anode material for lithium-ion batteries.

Advances in thermal technology and acid-leaching techniques that enable the production of higher purity graphite powders are likely to lead to development of new applications for graphite in high-technology fields. Such innovative refining techniques have enabled the use of improved graphite in carbon-graphite composites, electronics, foils, friction materials, and specialty lubricant applications. Flexible graphite product lines, such as graphoil (a thin graphite cloth), 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: The reserves data for Brazil, Mozambique, and Tanzania were revised based on information reported by graphite-producing companies and the Governments of those countries.

	Mine production		Reserves[2]
	2016	2017[e]	
United States	—	—	([3])
Brazil	95	95	70,000
Canada	30	30	([3])
China	780	780	55,000
India	149	150	8,000
Korea, North	6	6	([3])
Madagascar	8	7	1,600
Mexico	4	4	3,100
Mozambique	—	23	17,000
Norway	8	8	([3])
Pakistan	14	14	([3])
Russia	19	19	([3])
Sri Lanka	4	4	([3])
Tanzania	—	—	17,000
Turkey	4	4	90,000
Ukraine	15	15	([3])
Vietnam	5	5	([3])
Zimbabwe	6	6	([3])
Other	2	2	([3])
World total (rounded)	1,150	1,200	270,000

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.

[e]Estimated. — Zero.

[1]Defined as imports – exports.

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

[3]Included with "World total."