

**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 2003, approximately 200 U.S. firms, primarily in the Northeastern and Great Lakes regions, used it for a wide variety of applications. The major uses of natural graphite in 2003 were refractory applications, 25%; brake linings, 13%; foundry operations, 9%; lubricants, 8%; and other uses (including steelmaking), 45%.

| <b>Salient Statistics—United States:</b>                                 | <b>1999</b> | <b>2000</b> | <b>2001</b> | <b>2002</b> | <b>2003<sup>e</sup></b> |
|--|-------------|-------------|-------------|-------------|-------------------------|
| Production, mine   | —           | —           | —           | —           | —                       |
| Imports for consumption  | 56          | 61          | 52          | 45          | 53                      |
| Exports  | 29          | 22          | 24          | 22          | 21                      |
| Consumption, apparent <sup>1</sup>                                       | 26          | 39          | 28          | 24          | 32                      |
| Price, imports (average dollars per ton at foreign ports):               |             |             |             |             |                         |
| Flake  | 547         | 615         | 520         | 565         | 560                     |
| Lump and chip (Sri Lankan)   | 1,270       | 1,250       | 1,360       | 1,220       | 1,200                   |
| Amorphous  | 148         | 130         | 131         | 115         | 120                     |
| Stocks, yearend  | NA          | NA          | NA          | NA          | NA                      |
| Net import reliance <sup>2</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 recycling of graphite products. The market for recycled refractory graphite material is growing 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. Abundance of graphite in the world market and continuing low prices inhibit increased recycling efforts. Information on the quantity and value of recycled graphite is not available.

**Import Sources (1999-2002):** China, 33%; Mexico, 24%; Canada, 21%; Brazil, 6%; and other, 16%.

| <b>Tariff:</b> | <b>Item</b>                                  | <b>Number</b> | <b>Normal Trade Relations<br/>12/31/03</b> |
|----------------|--|---------------|--|
|                | Crystalline flake (not including flake dust) | 2504.10.1000  | Free.                                      |
|                | Other  | 2504.90.0000  | Free.                                      |

**Depletion Allowance:** 22% (Domestic lump and amorphous), 14% (Domestic flake), and 14% (Foreign).

**Government Stockpile:****Stockpile Status—9-30-03<sup>3</sup>**

| <b>Material</b>               | <b>Uncommitted inventory</b> | <b>Committed inventory</b> | <b>Authorized for disposal</b> | <b>Disposal plan FY 2003</b> | <b>Disposals FY 2003</b> |
|-------------------------------|------------------------------|----------------------------|--------------------------------|------------------------------|--------------------------|
| Sri Lanka, amorphous lump     | —                            | 0.68                       | —                              | 3.41                         | 0.02                     |
| Madagascar, crystalline flake | —                            | 1.12                       | —                              | —                            | 1.80                     |

## GRAPHITE (NATURAL)

**Events, Trends, and Issues:** Graphite was near supply-demand balance in 2003. Flake graphite imports were from Canada, China, Brazil, and Madagascar (in descending order of tonnage), imports of graphite lump and chip were from Sri Lanka; and amorphous graphite imports were from Mexico, China, and Japan (in descending order of tonnage). There has been a marked decrease in the consumption of graphite electrodes, owing to development of more efficient iron and steel production techniques. Use of natural graphite in lubrication applications is also decreasing because of changes in requirements for lubricants and in processing technologies. 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 special lubricant applications. Flexible graphite product lines, such as graphoil (a thin graphite cloth), probably will 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, Reserves, and Reserve Base:**

|                       | Mine production |                   | Reserves <sup>4</sup> | Reserve base <sup>4</sup> |
|-----------------------|-----------------|-------------------|-----------------------|---------------------------|
|                       | 2002            | 2003 <sup>e</sup> |                       |                           |
| United States         | —               | —                 | —                     | 1,000                     |
| Brazil                | 70              | 65                | 360                   | 1,000                     |
| Canada                | 25              | 25                | NA                    | NA                        |
| China                 | 450             | 450               | 64,000                | 220,000                   |
| Czech Republic        | 25              | 15                | 11,400                | 13,000                    |
| India                 | 130             | 110               | 800                   | 3,800                     |
| Korea, North          | 25              | 25                | NA                    | NA                        |
| Madagascar            | 1               | 10                | 940                   | 960                       |
| Mexico                | 25              | 20                | 3,100                 | 3,100                     |
| Other countries       | <u>62</u>       | <u>62</u>         | <u>5,100</u>          | <u>44,000</u>             |
| World total (rounded) | 810             | 780               | 85,000                | 280,000                   |

**World Resources:** Domestic resources are relatively small, but the rest of the world's inferred reserve base exceeds 800 million tons of recoverable graphite.

**Substitutes:** Manufactured graphite powder, scrap from discarded machined shapes, and calcined petroleum coke compete for use in iron and steel production. 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. NA Not available. — Zero.

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

<sup>2</sup>Defined as imports – exports + adjustments for Government and industry stock changes. Data on changes in stocks were not available and were assumed to be zero in the calculations.

<sup>3</sup>See Appendix B for definitions.

<sup>4</sup>See Appendix C for definitions.