# QUARTZ (HIGH-PURITY AND INDUSTRIAL CULTURED CRYSTAL)

(Data in metric tons unless otherwise specified)

**Domestic Production and Use:** Ground high-purity quartz (HPQ) is typically defined as ground natural quartz with less than 100 parts per million of impurities and has further defined standards for the concentrations of specific impurities allowed. HPQ has specialized end uses including electronics, fiber optic cables, fused quartz crucibles (for manufacturing silicon metal ingots that are later processed into silicon wafers for the photovoltaic cell and semiconductor markets), high-temperature lamp tubing, and specialty glass. In 2023, there were two companies that produced HPQ in the United States around Spruce Pine, NC. The HPQ in Spruce Pine was sourced from pegmatite rocks that were concurrently mined to produce feldspar and mica. The pegmatite rocks were processed through a number of procedures which include being crushed, washed and scrubbed, and sorted. Additional processing for the HPQ included being physically processed, chemically processed, and thermally processed. At least one of these companies sent their product overseas for further processing.

Industrial cultured quartz crystal is electronic-grade quartz crystal that is manufactured, not mined. In the past, cultured quartz crystal was primarily produced using lascas[1] as raw quartz feed material. Lascas mining and processing in Arkansas ended in 1997. In 2023, two companies produced cultured quartz crystal in the United States. However, production data were withheld in order to avoid disclosing company proprietary data. In addition to lascas, these companies may use cultured quartz crystal that has been rejected during the manufacturing process, owing to crystallographic imperfections, as feed material. The companies likely use a mix of cultured quartz and imported lascas as feed material. In the past several years, cultured quartz crystal has been increasingly produced overseas, primarily in Asia. Electronic applications accounted for most industrial uses of quartz crystal; other uses included special optical applications. Virtually all quartz crystal used for electronics was cultured, rather than natural, crystal. Electronic-grade quartz crystal is used to make frequency controls, frequency filters, and timers in electronic circuits employed for a wide range of products, such as communications equipment, computers, and many consumer goods, such as electronic games and television receivers.

| **Salient Statistics—United States:** | **2019** | **2020** | **2021** | **2022** | **2023[e]** |
|---|---|---|---|---|---|
| Ground high-purity quartz: | | | | | |
| Production[e, 2] | 100,000 | 100,000 | 100,000 | 200,000 | 200,000 |
| Imports[3] | NA | NA | NA | NA | NA |
| Exports[3] | NA | NA | NA | NA | NA |
| Price, range of value, dollars per metric ton[e, 4, 5] | 500–14,000 | 500–15,000 | 500–16,000 | 500–17,000 | 500–20,000 |
| Net import reliance[6] as a percentage of apparent consumption | NA | NA | NA | NA | NA |
| Industrial cultured quartz crystal: | | | | | |
| Production | W | W | W | W | W |
| Imports, piezoelectric | 55 | 114 | 69 | 76 | 77 |
| Exports, piezoelectric | 41 | 37 | 39 | 77 | 120 |
| Price, as-grown cultured quartz, dollars per kilogram[e, 4] | 200 | 200 | 200 | 200 | 200 |
| Price, lumbered quartz, dollars per kilogram[e, 4, 7] | 500 | 400 | 300 | 300 | 300 |
| Net import reliance[6] as a percentage of apparent consumption | NA | NA | NA | NA | NA |

**Recycling:** An unspecified amount of rejected cultured quartz crystal was used as feed material for the production of cultured quartz crystal.

**Import Sources (2019–22):** Import statistics specific to lascas and HPQ were not available because they were combined with other types of quartz. Cultured quartz crystal (piezoelectric quartz, unmounted): China,[8] 90%; Japan, 3%; Denmark, 2%; and other, 5%.

| **Tariff: Item** | **Number** | **Normal Trade Relations 12–31–23** |
|---|---|---|
| Sand containing 95% or more silica and not more than 0.6% iron oxide (including HPQ) | 2505.10.1000 | Free. |
| Quartz (including lascas and HPQ) | 2506.10.0050 | Free. |
| Piezoelectric quartz, unmounted | 7104.10.0000 | 3% ad valorem. |

Prepared by **Robert C. Goodin [(703) 648–7710, rgoodin@usgs.gov]**

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**Depletion Allowance:** 22% (domestic), 14% (foreign).

**Government Stockpile:**[9]

| | FY 2023 | | FY 2024 | |
|---|---|---|---|---|
| Material | Potential acquisitions | Potential disposals | Potential acquisitions | Potential disposals |
| Quartz crystal, kilograms | — | 7,148 | — | 7,148 |

**Events, Trends, and Issues:** Increased global manufacturing of silicon metal ingots that are later processed into silicon wafers for the photovoltaic cell and semiconductor markets has increased the demand for HPQ needed to make fused quartz crucibles. Growth of the electronics, fiber optic, and specialty glass markets are also likely to remain a factor in sustaining and increasing global demand for HPQ.

Increased trade of piezoelectric quartz in the past several years was likely the result of increased demand for frequency-control oscillators and vibration sensors for aerospace, automotive, and telecommunication applications. Growth of the consumer electronics market (for example, communications equipment, electronic games, personal computers, and tablet computers) is also likely to remain a factor in sustaining global demand for cultured quartz crystal.

**World Mine Production and Reserves:**[10] This information was not available. Global reserves of HPQ were thought to be limited to a few locations. The United States was estimated to be the leader in production of HPQ with other sources being in Australia, Brazil, Canada, China, India, and Russia. The global reserves for lascas were estimated to be large.

**World Resources:**[10] Limited resources of HPQ exist throughout the world. Limited resources of natural quartz crystal suitable for direct electronic or optical use exist throughout the world. World dependence on natural quartz crystal resources will continue to decline because of the increased acceptance of cultured quartz crystal as an alternative material. Additionally, techniques using rejected cultured quartz crystal as feed material may result in decreased dependence on lascas for growing cultured quartz.

**Substitutes:** No economic substitutes or alternatives for HPQ exist for most applications. Cultured quartz can be used as a substitute for HPQ, although it is not commonly done owing to the high price of cultured quartz.

Silicon is increasingly being used as a substitute for quartz crystal for frequency-control oscillators in electronic circuits. Other materials, such as aluminum orthophosphate (the very rare mineral berlinite), langasite, lithium niobate, and lithium tantalate, which have larger piezoelectric coupling constants, have been studied and used. Centrosymmetric materials that have induced piezoelectricity have also been studied. The cost competitiveness of these materials, as opposed to cultured quartz crystal, is dependent on the type of application that the material is used for, and the processing required.

[e]Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data. — Zero.

[1]Lascas is a nonelectronic-grade quartz used as a feedstock for growing cultured quartz crystal and for production of fused quartz. Lascas data are not included in this publication.

[2]Production is estimated from a combination of publicly available data, published sources, and industry trends. Data are rounded to the nearest hundred thousand metric tons to avoid disclosing company proprietary data.

[3]Trade data for ground high-purity quartz are included in Harmonized Tariff Schedule of the United States (HTS) codes 2505.10.1000 and 2505.10.1050 but are mixed with other types of sand and quartz. A reliable estimate cannot be made.

[4]Price is estimated from a combination of reported prices, trade data prices, and industry trends.

[5]Prices vary based on the percentage of quartz, percentage and type of impurities, and end use of the ground high-purity quartz.

[6]Defined as imports – exports.

[7]As-grown cultured quartz that has been processed by sawing and grinding.

[8]Includes Hong Kong.

[9]See Appendix B for definitions.

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