

## QUARTZ CRYSTAL (INDUSTRIAL)

(Data in kilograms unless otherwise noted)

**Domestic Production and Use:** 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<sup>1</sup> as raw quartz feed material. Lascas mining and processing in Arkansas ended in 1997. In 2022, 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.

<b><u>Salient Statistics—United States:</u></b>	<b><u>2018</u></b>	<b><u>2019</u></b>	<b><u>2020</u></b>	<b><u>2021</u></b>	<b><u>2022<sup>e</sup></u></b>
Production:					
Mine (lascas)	—	—	—	—	—
Cultured quartz crystal	W	W	W	W	W
Imports for consumption:					
Quartz (lascas)	NA	NA	NA	NA	NA
Piezoelectric quartz, unmounted	16,100	54,800	114,000	69,300	83,000
Exports:					
Quartz (lascas)	NA	NA	NA	NA	NA
Piezoelectric quartz, unmounted	43,400	40,900	37,100	39,300	<sup>2</sup> 60,000
Price, dollars per kilogram: <sup>e, 3</sup>					
As-grown cultured quartz	300	200	200	200	200
Lumbered quartz <sup>4</sup>	500	500	400	300	300
Net import reliance <sup>5</sup> 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 (2018–21):** Import statistics specific to lascas are not available because they are combined with other types of quartz. Cultured quartz crystal (piezoelectric quartz, unmounted): China,<sup>6</sup> 90%; Japan, 3%; Russia, 2%; and other, 5%.

<b><u>Tariff:</u></b>	<b><u>Item</u></b>	<b><u>Number</u></b>	<b><u>Normal Trade Relations</u></b>
	Quartz (including lascas)	2506.10.0050	<b><u>12–31–22</u></b>
	Piezoelectric quartz, unmounted	7104.10.0000	Free. 3% ad valorem.

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

**Government Stockpile:**<sup>7</sup> The National Defense Stockpile contains 11 weight classes for natural quartz crystal that range from 0.2 kilogram to more than 10 kilograms. The stockpiled crystals, however, are primarily in the larger weight classes. The larger pieces are suitable as seed crystals, which are very thin crystals cut to exact dimensions, to produce cultured quartz crystal. In addition, many of the stockpiled crystals could be of interest to the specimen and gemstone industry. Little, if any, of the stockpiled material is likely to be used in the same applications as cultured quartz crystal.

<b>Material</b>	<b>Inventory as of 9–30–22</b>	<b>FY 2022</b>		<b>FY 2023</b>	
		<b>Potential acquisitions</b>	<b>Potential disposals</b>	<b>Potential acquisitions</b>	<b>Potential disposals</b>
Quartz crystal	7,127	—	7,148	—	7,148

**Events, Trends, and Issues:** Increased imports of piezoelectric quartz in the past several years are 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 production of cultured quartz crystal.

**World Mine Production and Reserves:**<sup>8</sup> This information is unavailable, but the global reserves for lascas are thought to be large.

**World Resources:**<sup>8</sup> Limited resources of natural quartz crystal suitable for direct electronic or optical use are available throughout the world. World dependence on these 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:** 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.

<sup>6</sup>Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data. — Zero.

<sup>1</sup>Lascas is a nonelectronic-grade quartz used as a feedstock for growing cultured quartz crystal and for production of fused quartz.

<sup>2</sup>Export data were adjusted by the U.S. Geological Survey. The U.S. Census Bureau reported 193,000 kilograms of exports through August 2022. The data were being reviewed by the U.S. Census Bureau for errors.

<sup>3</sup>Price is estimated from a combination of reported prices, trade data prices, and industry trends.

<sup>4</sup>As-grown cultured quartz that has been processed by sawing and grinding.

<sup>5</sup>Defined as imports – exports.

<sup>6</sup>Includes Hong Kong.

<sup>7</sup>See Appendix B for definitions.

<sup>8</sup>See Appendix C for resource and reserve definitions and information concerning data sources.