Silicon Crystal (Si)

A **single crystal**, also called **monocrystal**, is a crystalline solid in which the crystal lattice of the entire sample is continuous and unbroken to the edges of the sample, with no grain boundaries.

The opposite of a single crystal sample is a **polycrystalline** sample, which is made up of a number of smaller crystals known as crystallites.

Because of a variety of entropic effects on the microstructure of solids, including the distorting effects of impurities and the mobility of crystallographic defects and dislocations, single crystals of meaningful size are exceedingly rare in nature, and can also be difficult to produce in the laboratory under controlled conditions.

Because grain boundaries can have significant effects on the physical and electrical properties of a material, single crystals are of interest to industry, and have important industrial applications. **The most notable of these is the use of single crystal silicon in the fabrication of semiconductors.** On the quantum scale that microprocessors operate on, the presence of grain boundaries would have a significant impact on the functionality of field effect transistors by altering local electrical properties. Therefore, microprocessor fabricators have invested heavily in facilities to produce large single crystals of silicon.

Fabrication of single crystals usually involves the building of a crystal layer by layer of atoms. Techniques to produce large single crystals (boules) include slowly drawing a rotating "seed crystal" in a molten bath of feeder material (as in the Czochralski process and the Bridgeman technique). Some thin film deposition techniques can be used for epitaxy, forming a new layer of material with the same structure on the surface of an existing single crystal.

Monocrystals are often made by **Czochralski** process, controlled crystallization from the melted material.

Application of Single Crystal
Monocrystals of silicon and other semiconductors are important for manufacture of integrated circuits.
Monocrystals of sapphire and other materials are used for lasers and nonlinear optics.
Monocrystals of fluorite are sometimes used in the objective lenses of apochromatic refracting telescopes.
Monocrystals of metals, especially superalloys, are used for their special mechanical properties. Turbine blades of some gas turbines are made of single crystal cast superalloy.

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Type	Dopant	Orientation	Resistivity (Ω·cm)	Diameter (mm)	Thickness (mm)
CZ Grown P Type	B	<111><100>	0.005-0.1	50-200	≥50
			0.1-10		
			10-25		
			25-60		
CZ Grown N Type	Sb	<111>	0.003-0.009		
		<100>	0.008-0.02		
	As	<111><100>	0.002-0.009		
	P	<111><100>	0.1-10		
	P	<111>	1-40		
		<100>	1-50		
	P	<111><100>	20-50		
Solar Energy Grade	P (CZ)	<100> ±3 Degree	0.5-3.0	150 ±0.5	>180
IC Grade Ingot	N/Phosphorus	<100> ±1 Degree Max	2.5-7.5	100 ±0.3	[Primary Flat: (011)] 32.5±2.5mm [Secondary Flat: 180 Degree From Primary Flat] 18.0±2.0mm
FZ Grown P Type	B	<111>	10-30 (±25%)	30-102	≥50
			30-80 (±25%)		
			80-250 (±25%)		
			250-1000 (±33%)		
			1000-10000 (±45%)	30-76	
NTD N Type Ingot	P	<111>	30-80 (±10)	30-102	
			80-200 (±10)		
			200-600 (±15)		
			5000-10000 (±10)	30-76	
Wafer				30-102	0.28-0.45

Quartz and other glass substrates/wafers/optics, and various crystal products are available. Contact us for more information!

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