Crystalox has supplied equipment and technology to more than 100 organisations around the world, regularly exporting more than 90% of its production. The Company received its second Queen's Award for Export Achievement in 1999.

Quality Assurance

Crystalox operates in accordance with international quality standards and has ISO9001 Quality Assurance accreditation for multicrystalline silicon production systems and material.

Development Programme

Crystalox participates in European research projects and maintains an active development programme directed towards material quality improvements and production cost reductions.

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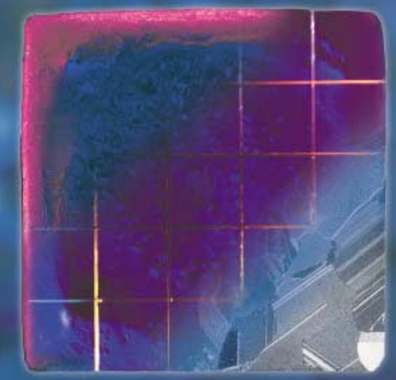
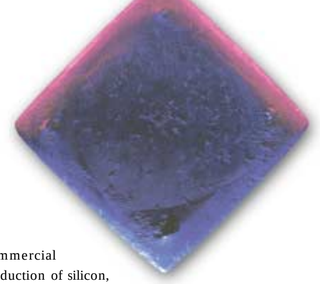


Multicrystalline silicon for photovoltaics

Multicrystalline silicon specialists

Multicrystalline silicon is increasingly replacing single crystal silicon as the material of choice for large scale commercial production of solar cells. Continued development by Crystalox of directional solidification technology has enabled multicrystalline silicon solar cells to demonstrate high efficiencies at lower production costs.

Crystalox has been producing multicrystalline silicon since 1990, supplying both ingots and wafers to the world's leading PV companies. With expertise in both silicon production and crystal growth equipment, Crystalox is uniquely positioned to meet the demands of the PV industry. These complementary activities ensure continuous optimisation of material quality and productivity and enable Crystalox to rapidly deliver benefits of technology advances to its customers.



Commercial production of silicon, using Crystalox PPVS systems, is carried out at Crystalox's ISO 9001 certified facilities near Oxford, UK. The optimised growth process and high purity conditions provide multicrystalline silicon ingots with large, highly oriented, vertical grain structure, necessary for high efficiency solar cells.

For more information on our range of production equipment please refer to our brochure *Multicrystalline silicon production systems*, or visit our website at **www.crystalox.com**

Ingots

Crystalox multicrystalline silicon ingots have dimensions 68 x 68cm square suitable for cutting into thirty-six 10 x 10cm, twenty-five 12.5 x 12.5cm or sixteen 15 x 15cm blocks.

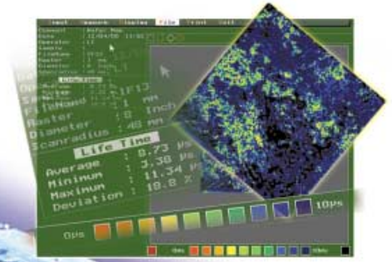
High efficiency solar cells are ensured by the Crystalox production process which provides ingots with the following critical characteristics:

- Ingot weight up to 275kg
- Directionally solidified, for large grain size
- Effective segregation to ensure very low impurity levels
- High minority-carrier lifetime
- Stress-free for high cutting/wafering yields

Wafers

Crystalox have formed an alliance with silicon wafering specialists PV Silicon, based in Germany, to supply high quality multicrystalline silicon wafers to the PV industry.

This collaboration combines Crystalox expertise in silicon crystallisation with PV Silicon's specialist knowledge in wire saw technology to deliver highest quality wafers at competitive prices.



An extensive quality system is used to ensure wafers meet customer requirements for high efficiency. Characterisation procedures provide continual control and monitoring of critical wafer parameters such as:

- thickness
- bow
- resistivity
- minority carrier lifetime

Documentation of all stages of manufacture ensures traceability of every wafer to its block, ingot and feedstock origins. This extensive information source enables Crystalox in cooperation with its customers to optimise wafers for specific cell processes.

Multicrystalline Silicon Wafers – *Typical specification**

Production:	
Growth Method:	**Crystalox PPVS System (Directional Solidification)**
Electrical:	
Resistivity:	**0.5 – 2 Ohm cm**
Conductivity Type:	**P (Boron-doped)**
Minority Carrier Lifetime:	**Typical: 5 – 8µs**
	Minimum: > 2µs
Chemical:	
Carbon Concentration:	**< 3 x 10^{17} atoms/cm^3**
Oxygen Concentration:	**< 1 x 10^{18} atoms/cm^3**
Physical:	
Dimensions:	**125 x 125 ± 0.5mm**
Thickness:	**330 ± 30µm**
Chamfer:	**2.5mm ± 0.5mm**
Squareness:	**90° ± 0.3°**
TTV:	**< 40µm**
Bow:	**< 60µm**
Surface Quality:	**Saw damage < 20µm**
	Crack-free
	Surface clean and free from visible contamination

** Alternative specifications available to meet customer requirements.*