



MATERIALS SUBSTRATES

- Silicon Wafers J 04

NEYCO has a complete range of substrates for a wide variety of applications, including Semiconductor, Biotechnology, Nanotechnology, and MEMS. NEYCO is your one stop source for advanced materials for both R&D laboratory use and industry production.



STANDARD SINGLE CRYSTAL SUBSTRATE PARAMETERS

Substrates and wafers are manufactured by a technology, which is specially adapted to the respective material. Additionally we produce substrates and wafers customer-specific in all possible orientations, sizes and geometries and with smaller tolerance.

Orientations	(100), (111), (110) for cubic crystals (110), (001) for tetragonal crystals (0001), (1-102), (11-20), (10-10) for hexagonal crystals (110), (001) for orthorhombic crystals other orientations on request Standard: edges are oriented
Tolerance of orientation	Maximum 30' ; typical < 20' higher precision on request
Standard sizes	10x10 mm, 10x5 mm, 12.7x12.7 mm, 15x15 mm, 20x20 mm, 25x25 mm, \varnothing 1", \varnothing 2", \varnothing 3" other sizes on request
Tolerance of sizes	+0/-0.05 mm
Thickness	0.5 mm, 1.0 mm (standard) other thicknesses down to 0.1 mm on request
Tolerance of thickness	+0.05/-0.05 mm
Polish	One side, two sides optical polish of lateral sides (cylinders) on request
Surface quality	Scratchfree at magnification of 50
Roughness: (at $\lambda_{\text{cutoff}} = 0.08 \text{ mm}$)	Ra: typ. 0.5 nm Rq: typ. 1.0 nm Rt: typ. 2.0 nm
Parallelity	Typ. better than 10'
Flatness	Max. 1 μm /10 mm (test region 98% of the wafer area)

Micro-roughness measured with Kugler Interferometermicroscope (lateral resolution: 0.64 μm , vertical resolution (theoretically): 0.01 nm).

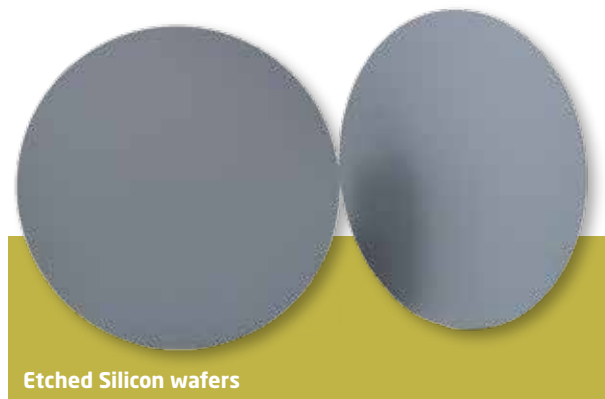
Silicon Wafers

MATERIALS CHARACTERISTICS

Silicon wafers are cut from silicon single crystal using internal diameter diamond discs. Silicon wafers are lapped of both sides with abrasive mixture. After cutting or lapping the wafers are washed in ultrasonic washers or undergo active washing. The wafers' edges are mechanically rounded. Silicon wafers are etched in acid mixture or alkaline. Wafers surface is alkaline or acid etched according to the customer's request. Active sides of the wafers (for single side polished wafers) or both sides (for two sides polished wafers) are chemo-mechanically polished.

The mentioned parameters are dealing with our standard production. On the customer's request we are ready to discuss orders for wafers with some other parameters, for instance:

- Low radial resistivity variation (RRV) combined with the uniform distribution of dopants in the crystal (this parameter depends on shape of phase boundary and the



Etched Silicon wafers

phenomena in the boundary layer during monocrystallization process).

- Perfect crystallographic structure of material (free from swirls, with dislocations density lower than recommended by SEMI standard - 500/cm²).
- Low oxygen concentration ($O_2 < 30$ ppm).
- Tolerance of orientation better than 0.10°.
- Very good polished surface (one or both sides polished depending on technology and the type of products).



Polished Silicon wafers

STANDARD SPECIFICATIONS

CRYSTAL GROWTH						
Growth method	Czochralski (CZ) Floating zone (FZ)					
Orientation	<100>, <111>, <110>					
Diameters	1" to 300 mm					
CRYSTALLOGRAPHIC PROPERTIES						
Crystal structure	Cubic a = 0.543 nm					
Dopant available	P-type: Boron N-type: Phosphorus, Antimony or Arsenic					
PHYSICAL PROPERTIES						
Density	2.329 g.cm ⁻³					
Melting point	1417°C					
Hardness	7 Mohs					
Thermal expansion	2.3 - 4.7.10 ⁻⁶ K ⁻¹ (as per doping specification)					
Resistivity range	0.001 - 10 000 Ω.cm					
Band gap (at 273 K)	1.106 eV					
Thermal conductivity	147 W.m ⁻¹ .K ⁻¹					
Carrier mobility	μ _e = 1350 cm ² .V ⁻¹ .s ⁻¹ μ _h = 480 cm ² .V ⁻¹ .s ⁻¹					
Conductivity type	P-type or N-type					
CHEMICAL PROPERTIES						
Solubility in water	0.005 g/100 cm ³					
Solubility in acids	Soluble					
Solubility in organic solvents	Insoluble					
OPTICAL PROPERTIES						
Absorption coefficient	0.01 cm ⁻¹ at 5 μm					
Transmission range (thickness 2 mm)	1.2 - 15.0 μm					
Refractive index n	3.0 μm	5.0 μm	6.0 μm	7.0 μm	8.0 μm	10.0 μm
	3.432	3.422	3.420	3.419	3.418	3.417
OTHER PROPERTIES						
Flat / notch	Semi STD, Single flat, None					
Surface finish	SSD (Single side polished), DSP (Double side polished), ascut, lapped, etched					
Roughness	Ra <0.5 nm, Ra <4 nm					

SI WAFERS PRIMARY & SECONDARY FLATS

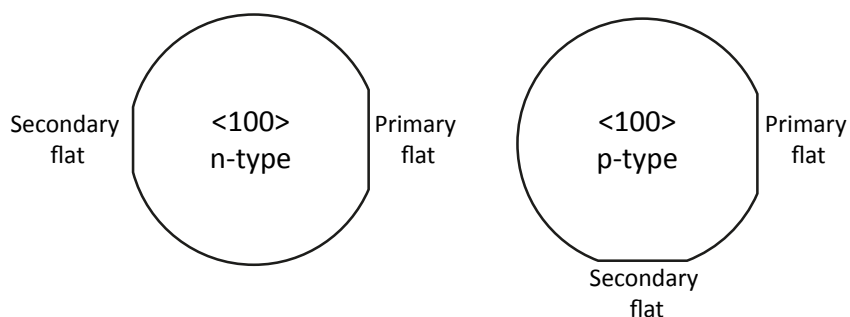
- Primary flat: The flat of longest length located in the circumference of the wafer. The primary flat has a specific crystal orientation relative to the wafer surface; major flat.
- Secondary flat: Indicates the crystal orientation and doping of the wafer. The location of this flat varies.

Flats dimensions

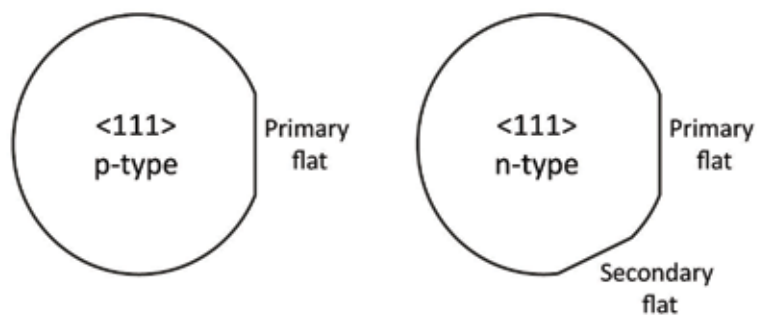
WAFERS DIAMETER	LENGTH OF PRIMARY FLAT	LENGTH OF SECONDARY FLAT
2"	15.9 mm ± 1 mm	7.9 mm ± 1.5 mm
3"	22.2 mm ± 2 mm	11.1 mm ± 1.6 mm
4"	32.5 mm ± 2.5 mm	18 mm ± 2 mm

Flats locations

Orientation : <100> flat at 180° for n-type and 90° for p-type



Orientation : <111> flat at 45° for n-type and no secondary for p-type



TRANSMISSION SPECTRUM (high resistivity Si)



RECOMMENDED APPLICATIONS

Wafer Resistivity ($\Omega\cdot\text{cm}$)	< 0.05	1 - 5	6 - 12	> 30
Application	Epitaxial substrate	Solar cell	IC, OE devices or sensors	Special device or component

SERVICES ON SILICON WAFERS

THERMAL OXIDATION AND NITRURATION

We offer a service of thermal oxidation (by dry or wet way) on our wafers. The oxidation thickness can be from 50 nm to 5 μm . The oxidation on one side is also possible.

We also offer a service of nitriding Si_3N_4 (classical at 800°C or low stress at 835°C) on our wafers.

Thickness: from 50 nm to 5 μm .



Thermal nitriding on Si wafer

VACUUM COATINGS ON WAFER

We make special vacuum coatings on wafers (for example: precoating of Chromium or Titanium before a thin film of Gold, or any other E-beam evaporated or sputtered material).

DICING OF WAFERS

We offer the dicing of the wafers in square or rectangular parts.

For examples:

- 10 mm x 10 mm
- 5 mm x 5 mm
- 5 mm x 10 mm,...

SINGLE WAFER CONTAINER

Single Silicon wafer carrier, or for other delicate flat substrates, from 1" to 6".

Material: natural PP
Color: Transparent

Packaging:

- 1 piece
- per 25 clean room bagged.

Contact us for your specific needs



P/N	WAFERS SIZE	PACKAGING
BWA1S	1"	1 piece
BWA2S	2"	
BWA3S	3"	
BWA4S	4"	
BWA5	5"	
BWA6	6"	
BWA1-25	1"	25 pieces
BWA15-25	1.5"	
BWA2-25	2"	
BWA25-25	2.5"	
BWA3-25	3"	
BWA4-25	4"	
BWA5-25	5"	
BWA6-25	6"	

Single Crystal Substrates

• Al ₂ O ₃ Sapphire substrate	J 10	• MgAl ₂ O ₄ Magnesium Aluminum Oxide substrate	J 29
• BaF ₂ Barium Fluoride substrate	J 11	• MgF ₂ Magnesium Fluoride substrate	J 30
• BaTiO ₃ Barium Titanate substrate	J 12	• MgO Magnesium Oxide substrate	J 31
• CaF ₂ Calcium Fluoride substrate	J 13	• MnO Manganese Oxide substrate	J 32
• CaNdAlO ₄ (CNAO) Calcium Neodymium Aluminate substrate	J 14	• NaCl Sodium Chloride substrate	J 33
• CdS Cadmium Sulfide substrate	J 15	• NdGaO ₃ Neodymium Gallate (NGO) substrate	J 34
• CdSe Cadmium Selenide substrate	J 15	• NiO Nickel Oxide substrate	J 34
• CdTe Cadmium Telluride substrate	J 16	• SiO ₂ Quartz substrate	J 35
• CoO Cobalt Oxide substrate	J 17	• SrLaAlO ₄ Strontium Lanthanum Aluminate substrate	J 36
• Cr ₂ O ₃ Chromium Oxide substrate	J 17	• SrLaGa ₃ O ₇ Strontium Lanthanum Gallate substrate	J 36
• GaAs Gallium Arsenide substrate	J 18	• SrLaGaO ₄ Strontium Lanthanum Gallate substrate	J 37
• GaP Gallium Phosphide substrate	J 19	• SrTiO ₃ Strontium Titanate substrate	J 38
• Gd ₃ Ga ₅ O ₁₂ Gadolinium Gallium Garnet (GGG) substrate	J 20	• TiO ₂ Titanium Oxide (Rutile) substrate	J 39
• Ge Germanium substrate	J 21	• Y ₃ Al ₅ O ₁₂ Yttrium Aluminium Garnet (YAG) substrate	J 40
• InAs Indium Arsenide substrate	J 22	• YAlO ₃ Yttrium Aluminate (YAP) substrate	J 41
• InP Indium Phosphide substrate	J 23	• Ytria Stabilized Zirconia (YSZ) substrate	J 41
• LaAlO ₃ Lanthanum Aluminate substrate	J 24	• ZnO Zinc Oxide substrate	J 42
• LiAlO ₂ Lithium Aluminate substrate	J 25	• ZnS Zinc Sulfide substrate	J 43
• LiF Lithium Fluoride substrate	J 25	• ZnSe Zinc Selenide substrate	J 44
• LiGaO ₂ Lithium Gallate substrate	J 27	• ZnTe Zinc Telluride substrate	J 45
• LiNbO ₃ Lithium Niobate substrate	J 27		
• Lithium-Strontium-Aluminum-Tantalum-Oxide (LSAT) substrate	J 28		



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