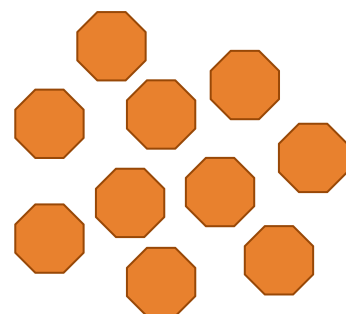


CRYSTALS & SUBSTRATES

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VI HALBLEITERMATERIAL has a series of substrates for semiconductor, optic area applications.

What We Offer?

- ◆ Silicon Wafers
- ◆ Crystal Substrates
- ◆ Single crystals



Standard SINGLE CRYSTAL substrate parameters

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 λ Cutoff = 0.08 mm)	Ra: typ. 0.5 nm Rq: typ. 1.0 nm Rt: typ. 2.0 nm
Parallelity	Typ. better than 10'
Flatness	Max. 1 μ m/10 mm (test region 98% of the wafer area)

Crystal & Substrates Materials List

1. High temperature superconduct film substrates								
Crystal	Structure	Melting point (°C)	Density (g/cm ³)	Rigidity (M)	Thermal expansion ×10 ⁻⁶ /K)	Dielectric Constant	Growth Tech& Max Size	Standard wafer (1sp or 2sp)
LaAlO ₃	Rhombo (≈Cubic) a=3.821Å	2100	6.52	6.5	9.2	24.5	CZ φ3"	φ3"×0.5mm φ2"×0.5mm φ1"×0.5mm 10×10×0.5mm
LSAT (LaAlO ₃) _{0.3} (Sr ₂ AlTaO ₈) _{0.7}	Cubic a=3.868Å	1840	6.74	6.5	10	22	CZ φ2"	φ2"×0.5mm 10×10×0.5mm
SrTiO ₃	Cubic a=3.90Å	2050	5.175	6	10.4	300	CZ φ30mm	10×10×0.5mm 10×5×0.5mm
MgO	Cubic a=4.216Å	2852	3.58	5.5~ 6	12.8	9.8	Flux 50*50*20	φ2"×0.5mm 10×10×0.5mm
YSZ	Cubic c=5.125Å	2500	5.8	7	10.3	27	CZ φ2"	φ2"×0.5mm 10×10×0.5mm
NdGaO ₃	Orther a=5.43Å b=5.5Å c=7.71Å	1600	7.57	6	7.8	25	CZ φ2"	φ2"×0.5mm 10×10×0.5mm
SrLaAlO ₄	Tetrag a=3.756Å c=12.63Å	1650	5.92	6	<100>10.05 <001>18.9	16.8	CZ φ20mm	10×10×0.5mm
YAlO ₃	Orther a=5.3286Å b=7.3706Å c=5.1796Å	1870	5.37	8.5	4.2 //a 11.7 //b 5.1 //c		CZ φ2"	10x10x0.5m m

2. Magnetism film and ferroelectric crystal substrate								
Crystal	Structure	Melting point (°C)	Density (g/cm ³)	Rigidity (M)	Thermal expansion (×10 ⁻⁶ /K)	Dielectric constant	Growth Tech & Max Size	Standard wafer (1sp or 2sp)
LaAlO ₃	Rhombo (≈Cubic) a=3.821Å	2100	6.52	6.5	9.2	24.5	CZ φ3"	φ3"×0.5mm φ2"×0.5mm φ1"×0.5mm 10×10×0.5mm
SrTiO ₃	Cubic a=3.90Å	2050	5.175	6	10.4	300	Vernuil φ30mm	10×10×0.5mm 10×5×0.5mm
Nb:SrTiO ₃	Cubic a=3.90Å	2050	5.175	6			Vernuil φ25mm	10×10×0.5mm 10×5×0.5mm
Al ₂ O ₃	Hexagonal a=4.758Å c=12.99Å	2040	3.97	9	7.5		CZ φ50mm	φ50×0.33 φ25×0.5 10×10×0.5
MgAl ₂ O ₄	Cubic a=8.083Å	2130	3.6	7.5~8	7.45		CZ φ2"mm	φ2"×0.5 10×10×0.5
GGG (Gd ₃ Ga ₅ O ₁₂)	Cubic a=12.37Å	1860	7.05	6~7			CZ φ2"mm	φ2"×0.5 10×10×0.5
TiO ₂	Tetrag a=4.593Å c=2.958Å	1840	4.26	7			Vernuil Dia23~25	10×10×0.5mm 10×5×0.5mm

3. GaN extension film substrates								
Crystal	Structure	Melting point (°C)	Density (g/cm ³)	Rigidity (M)	Thermal expansion (×10 ⁻⁶ /K)	Lattice mismatch to GaN	Growth Tech & Max Size	Standard wafer (1sp or 2sp)
Al ₂ O ₃	Hexagonal a=4.758Å c=12.99Å	2040	3.97	9	7.5	14%at<0001> ori	CZ φ50mm	φ50×0.33 φ25×0.5 10×10×0.5
MgO	Cubic a=4.216Å	2852	3.58	5.5~6	12.8	3%at<111>ori	CZ 50*50*20	φ2"×0.5mm 10×10×0.5mm
LSAT (LaAlO ₃) _{0.3} (Sr ₂ AlTaO ₈) _{0.7}	Cubic a=3.868Å	1840	6.74	6.5	10	1%at<111>ori	CZ φ2"	φ2"×0.5mm 10×10×0.5mm
LiAlO ₂	Tetrag a=5.17Å c=6.26Å	1900	2.62	7.5		1.4%at<100>o ri.	CZ φ2"	Dia2"×0.5 10×10×0.5
MgAl ₂ O ₄	Cubic a=8.083Å	2130	3.6	7.5~8	7.45	9%at<111>ori	CZ φ2"mm	φ2"×0.5 10×10×0.5

SiC	Hexagonal a=3.080Å c=15.12Å	2700	3.217	9.2	10.3	3.5%at<0001> ori.	CVD φ50	10×10×0.3
ZnO	Hexagonal a=3.325Å c=5.213Å	1975	5.605	4.5	2.9	2.2%at<0001> ori.	Hydrothermal 25mm	20×20×0.5

4. Semiconductor substrates

Crystal	structure	Melting point (°C)	Density g/cm3	conduct Type	Doping	resistance ratio Ω. cm	Growth Tech & Max Size	Standard wafer (1sp or 2sp)
Si	Cubic a=5.0430	1415	2.33	/	undoped	102~104	CZ φ8"	φ 2"x0.5
				N	P	0.001~40		φ 3"x0.5
				P	B	0.001~40		φ 4"x0.5
Ge	Cubic a=5.6575	937.4	5.76 5	/	undoped	>35	CZ φ4"	φ 2"x0.5 φ 3"x0.5 φ 4"x0.5

III-V Semiconductor substrates

Crystal	structure	Melting point(°C)	Doping	conduct Type	Carrier concentration cm-3	EPD cm-2	Growth Tech & Max Size	Standard wafer (1sp or 2sp)
		Density (g/cm3)						
GaP	Cubic	1480 °C 4.13 g/cm3	S	N	2- 8x10 ¹⁷	< 104 φ50	VGF	φ2"x0.28
GaAs	Cubic a=5.653	1238°C	None Zn	Si N P	/	<5x10 ³	VGF & HB φ4"	φ3"x0.5
/		5.31g/cm3			2~x10 ¹⁸			φ2"x0.5
InP	Cubic a=5.243	1062°C	None Sn	N N N Si	1-2x10 ¹⁶	<5x10 ⁴	VGF φ3"	φ3"x0.35
		6.719g/cm3	S	P	1-3x10 ¹⁸			
			Fe Zn		1-4x10 ¹⁸			
					6-4x10 ¹⁸			
InAs	Cubic a=6.058	5.699g/cm3	None	N	1-2x10 ¹⁶	<5x10 ⁴	VGF φ3"mm	φ3"x0.5

II-VI Semiconductor substrates

Crystal	Structure	Melting point (°C)	Density (g/cm3)	Heat capacity (J /g.k)	Thermal expansion (×10-6/K)	Thermal conductivity(W /m.k at300K)	Transparent wavelength (μ)	Refractive index	Growth Tech& max size
ZnSe	Cubic F43m a =5.6685	1517	5.264	0.339	7.1	13	0.51 ~ 19.0	2.5	PVT 25x25x15

ZnO	Hexagonal P63mc a=3.325 c=5.213	1975	5.605	0.125	6.5 // a 3.7 // c	30	0.4 ~ 0.6	1.922(o) 1.936(e)	Hydrother mal 20x20x10
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5. Birefringent Crystal

Crystal	Structure	Density g/cm ³	Rigidity (M)	Melting point	Thermal expansion ($\times 10^{-6}/K$)	Dielectric constant	Growth Tech & Max Size	Standard wafer (1sp or 2sp)
LiNbO ₃	ca=b=5.148 Å, c=13.863 Å	4.64	5	1250	a ₁₁ =15.4 $\times 10^{-6}/K$ a ₃₃ =7.5 $\times 10^{-6}/K$	n ₀ =2.286 n _e =2.203 @632.8nm	Ø3"	Ø3"x0.5 Ø2"x0.5 10x10x0.5
LiTaO ₃	Hexagona a=b=5.153 c=13.75	7.43	5	1650	a a= 1.6 x 10 ⁻⁶ / k a c= 4.1 x 10 ⁻⁶ / k	n ₀ =1.9929, n _e =2.2154, @ 630nm	Ø3"	Ø3"x0.5 Ø2"x0.5 10x10x0.5
SiO ₂	Hexagona a= 4.914 Å c = 5.405 Å	2.684	7	1610	a ₁₁ =13.71 a ₃₃ =7.48	1.544	Ø4"	Ø4"x0.5 Ø3"x0.5 Ø2"x0.5
YVO ₄	Tetrag , a=b=7.12Å ; c=6.29 Å	4.22	5	1825	a=5.32W/(m.k); c= 5.10 W/(m.K)	n ₀ = 2.176 n _e = 2.180 @ 633 nm	Ø30	10x10x0.5 10x5x0.5
Bi ₄ Ge ₃ O ₁₂	Cubic a=10.52	7.092	5	1045		2.15	Ø2"	Ø2"x0.3
TiO ₂	Tetrag a=4.5936 Å, c= 2.9582 Å	4.26	7	1840	a=7.14x10 ⁻⁶ c=9.19x10 ⁻⁶	n ₀ = 2.47 n _e = 2.73 @1300nm	Ø22	Ø20x0.5 10x10x0.5