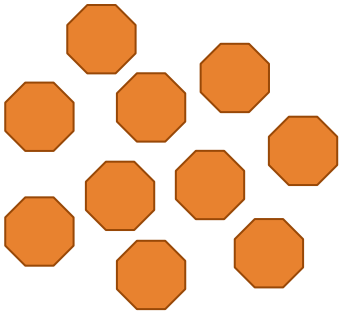
CRYSTALS & SUBSTRATES

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

What We Offer?

- Silicon Wafers
- Crystal Substrates
- Single crystals



Standard SINGLE CRYSTA L 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, ø 1’’, ø 2’’, ø 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 temperture superconduct film substrates								
Crystal	**Structure**	**Melting point (℃)**	**Density (g/cm3)**	**Rigidity (M)**	**Thermal expansion ×10-6/K)**	**Dielcctric Constant**	**Growth Tech& Max Size**	**Standard wafer (1sp or 2sp)**
LaAlO3	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 (LaAlO3)0.3 (Sr2AlTaO8)0.7	Cubic a=3.868Å	1840	6.74	6.5	10	22	CZ ϕ2"	ϕ2"×0.5mm 10×10×0.5mn
SrTiO3	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
NdGaO3	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
SrLaAlO4	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
YAlO3	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 flim and ferroelectric crystal sbustrate

Crystal	Structure	Melting point (℃)	Density (g/cm3)	Rigidity (M)	Thermal expansion (×10-6/K)	Dielcctric constant	Growth Tech & Max Size	Standard wafer (1sp or 2sp)
LaAlO3	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
SrTiO3	Cubic a=3.90Å	2050	5.175	6	10.4	300	Vernuil ϕ30mm	10×10×0.5mm 10×5×0.5mm
Nb:SrTiO3	Cubic a=3.90Å	2050	5.175	6			Vernuil ϕ25mm	10×10×0.5mm 10×5×0.5mm
Al2O3	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
MgAl2O4	Cubic a=8.083Å	2130	3.6	7.5～8	7.45		CZ ϕ2"mm	ϕ2"×0.5 10×10×0.5
GGG (Gd3Ga5O12)	Cubic a=12.37Å	1860	7.05	6～7			CZ ϕ2"mm	ϕ2"×0.5 10×10×0.5
TiO2	Tetrag a=4.593Å c=2.958Å	1840	4.26	7			Vernuil Dia23~2 5	10×10×0.5mm 10×5×0.5mm

3. GaN extension film substrates

Crystal	Structure	Melting point (℃)	Density (g/cm3)	Rigidity (M)	Thermal expansion (×10-6/K)	Lattice mismatch to GaN	Growth Tech& Max Size	Standard wafer (1sp or 2sp)
Al2O3	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 (LaAlO3)0.3 (Sr2AlTaO8)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
LiAlO2	Tetrag a=5.17Å c=6.26Å	1900	2.62	7.5		1.4%at<100>o ri.	CZ ϕ2"	Dia2"x0.5 10×10×0.5
MgAl2O4	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.	Hydrot hermal 25mm	20×20×0.5

4. Semiconductor substrates

Crystal	structure	Melting point (℃)	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	/ N P	undopped P B	102～104 0.001~40 0.001~40	CZ Φ8"	Ø 2"x0.5 Ø 3"x0.5 Ø 4"x0.5
Ge	Cubic a=5.6575	937.4	5.76 5	/	undopped	>35	CZ Φ4"	Ø 2"x0.5 Ø 3"x0.5 Ø 4"x0.5

III-V Semiconductor substrates

Crystal	structure	Melting point(℃) Density (g/cm3)	Doping	conduct Type	Carrier concentration cm-3	EPD cm-2	Growth Tech & Max Size	Standard wafer (1sp or 2sp)
GaP	Cubic	1480 ℃ 4.13 g/cm3	S	N	2- 8x1017	< 104 Ø50	VGF	Ø2"x0.28
GaAs /	Cubic a=5.653	1238℃ 5.31g/cm3	None Si Zn	SI N P	/ >5x1017 2~x1018	<5x103	VGF & HB Ø4"	Ø3"x0.5 Ø2"x0.5
InP	Cubic a=5.243	1062℃ 6.719g/cm3	None Sn S Fe Zn 	N N N SI P 	1-2x1016 1-3x1018 1-4x1018 / 6-4x1018	<5x104	VGF Ø3"	Ø3"x0.35
InAs	Cubic a=6.058	5.699g/cm3	None	N	1-2x1016	<5x104	VGF Ø3”mm	Ø3”x0.5

II-VSemiconductor substrates

Crystal	Structure	Melting point (℃)	Densiy (g/cm3)	Heat capacity (J /g.k)	Thermal expansion (×10-6/K)	Thermal conductivity(W /m.k at300K)	Transparent wavelength (μ)	Refrac-tive 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

5. Birefringent Crystal

Crystal	Structure	Density g/cm3	Rigidity (M)	Melting point	Thermal expansion (×10-6/K)	Dielcctric constant	Growth Tech & Max Size	Standard wafer (1sp or 2sp)
LiNbO3	ca=b=5.148 Å, c=13.863 Å	4.64	5	1250	a11=15.4×10-6/K a33=7.5×10-6/K	n0=2.286 ne=2.203 @632.8nm	Ø3"	Ø3"x0.5 Ø2"x0.5 10x10x0.5
LiTaO3	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	no=1.9929, ne=2.2154, @ 630nm	Ø3"	Ø3"x0.5 Ø2"x0.5 10x10x0.5
SiO2	Hexagona a= 4.914 Å c = 5.405 Å	2.684	7	1610	a11=13.71 a33=7.48	1.544	Ø4"	Ø4"x0.5 Ø3"x0.5 Ø2"x0.5
YVO4	Tetrag , a=b=7.12Å ; c=6.29 Å	4.22	5	1825	a=5.32W/(m.k)； c= 5.10 W/(m.K)	no = 2.176 ne = 2.180 @ 633 nm	Ø30	10x10x0.5 10x5x0.5
Bi4Ge3O12	Cubic a=10.52	7.092	5	1045		2.15	Ø2"	Ø2"x0.3
TiO2	Tetrag a=4.5936 Å, c= 2.9582 Å	4.26	7	1840	a=7.14x10-6 c=9.19x10-6	n0 = 2.47 ne = 2.73 @1300nm	Ø22	Ø20x0.5 10x10x0.5