

天通控股股份有限公司  
TDG HOLDING CO., LTD.

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# PROFESSIONAL CRYSTAL MATERIAL MANUFACTURER

专业晶体材料制造商

**TDG**

股票代码 (Stock Code): 600330

## Company Profile

### 公司简介



Founded in 1984, TDG (Stock Code : 600330) is the first public company held by individuals in China, which has possessed several holding companies and share holding companies. TDG is a key national Hi-Tech corporation integrating R&D, manufacturing and marketing, focusing on electronic materials & components, special high-end equipment, and investment and incubation emerging industry.

天通控股股份有限公司(证券代码: 600330)创立于1984年,是拥有多个控股公司和参股公司的中国首家由自然人直接控股的上市公司。经过结构调整,天通已形成电子材料、电子部品、智能装备和产业投资四大业务板块。是集科研、制造、销售于一体的国家重点高新技术企业。

# SAW Grade Crystal

Application:  
SAW Devices

SAW grade LN, LT crystals are the featured products of TDG Holding Co., Ltd. Variation of SAW propagation velocity may arise from the fluctuation of crystal components, uncompleted crystal poling and crystal defects. So, to ensure the SAW propagation velocity consistent and to meet customer's increasing requirement on crystal quality, such strict measures as quality and precise component ratio control of  $Nb_2O_5$ ,  $Ta_2O_5$  and  $Li_2CO_3$  raw materials, Curie temperature measurement, defects inspection as well as optimized crystal growth and poling process, are taken.

Crystal Categories	LiNbO <sub>3</sub> Crystal	LiTaO <sub>3</sub> Crystal
Crystal Orientation	X, Y, Z, 36°Y, 41°Y, 45°Y, 64°Y, 128°Y, 135°Y	Z, 36° Y, 42° Y, X-112° Y
Orientation Fluctuation	±0.1°	
Diameter	76.2±0.2mm, 100.0±0.2mm, 150±0.2mm	
Length	50~150mm	
Curie Temperature	1142°C±2°C	603°C±2°C
Orientation of First Reference Flat	±0.2°	
First Reference Flat	22±2mm(3" ), 32±2mm(4" ), 47.5±2mm(6" )	
Second Reference Flat	10±2mm, 12±2mm	
Quality	Free of Crack, bubbles and inclusions	

\* The above index are for reference  
\* Other specifications could be customized

# 声表面波级晶体

应用领域:  
声表面波器件



声表面波级LN、LT晶体是天通的基础产品。SAW传播速度的一致性为SAW器件生产商对SAW材料的基本要求。LN、LT晶体的组份变化、极化的不完整和内部缺陷会引起SAW传播速度的变化。通过严格控制 $Nb_2O_5$ 、 $Ta_2O_5$ 和 $Li_2CO_3$ 原料的批次质量变化和两者配置比例，并以成熟的晶体生长和单畴化工艺，居里温度测试和内部质量检查等措施来满足客户对产品越来越高的质量要求。

晶体类别	铌酸锂单晶	钽酸锂单晶
晶体轴向	X, Y, Z, 36°Y, 41°Y, 45°Y, 64°Y, 128°Y, 135°Y	Z, 36° Y, 42° Y, X-112° Y
轴向精度	±0.1°	
直径	76.2±0.2mm, 100.0±0.2mm, 150±0.2mm	
长度	50~150mm	
居里温度	1142°C±2°C	603°C±2°C
第一参考面定向精度	±0.2°	
第一参考面	22±2mm(3" ), 32±2mm(4" ), 47.5±2mm(6" )	
第二参考面	10±2mm, 12±2mm	
宏观质量	无开裂、气泡及杂质	

\* 以上参数仅供参考  
\* 特殊规格按照客户要求定制

# SAW Grade LiTaO<sub>3</sub> (LT) Wafer

## Application:

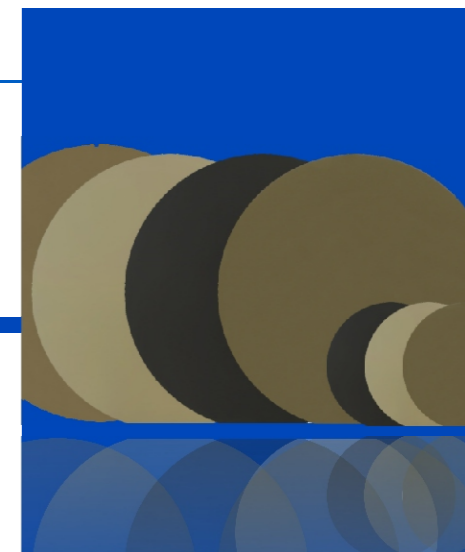
### SAW Devices

- ▶ Providing various LT wafers for SAW and BAW fabrications.
- ▶ Key properties influencing the yield of SAW devices are examined.
- ▶ And our patented product-low static black or gray LN wafers, are also available.

<b>Orientation</b>	36°rot. Y-cut±0.2°	42°rot. Y-cut±0.2°	X-cut±0.2°
<b>Diameter</b>	76.2±0.2mm	100.0±0.2mm	150.0±0.2mm
<b>Orientation Flat (OF)</b>	22±2mm, 32±2mm, 47.5±2mm Perpendicular to X±0.2°		22±2mm, 32±2mm, 47.5±2mm Perpendicular to 112.2°Y±0.2°
<b>Second Refer Flat (RF)</b>	10mm±2mm SOF:Cw270°±1° from OF	10mm±2mm SOF:Cw315°±1° from OF	10mm±2mm SOF:Cw315°±1° from OF TOF:Cw270°±1° from OF
<b>Thickness</b>	200~250±20um, 350±20um, 500±20um		
<b>Propagating Surface</b>	"+" side Ra≤10Å		
<b>wafer Backside</b>	GC#1000 lapped/etched, GC#2000 lapped/etched		
<b>TTV</b>	≤5um		
<b>LTV</b>	≤0.5um within an area of 5*5mm		
<b>PLTV</b>	≥95%(3mm from edge excluded)		
<b>BOW</b>	-25um≤Bow≤+25um		
<b>Curie Temperature</b>	603°C±2°C (DTA method)		
<b>Edge Beveling</b>	Edge grinding		

\* The above index are for reference  
\* Other specifications could be customized

# 声表面波级钽酸锂晶片



## 应用领域:

### 声表面波器件

- ▶ 提供适用于SAW和BAW器件制作要求的各种LT晶片。
- ▶ 影响SAW器件成品成品率的关键指标会被逐项检查。
- ▶ 亦可供应我们的专利技术产品-低静电黑色或灰色LT晶片。

<b>轴向</b>	36°rot. Y-cut±0.2°	42°rot. Y-cut±0.2°	X-cut±0.2°
<b>直径</b>	76.2±0.2mm	100.0±0.2mm	150.0±0.2mm
<b>基准面</b>	22±2mm, 32±2mm, 47.5±2mm 垂直于 X±0.2°		22±2mm, 32±2mm, 47.5±2mm 垂直于112.2°Y±0.2°
<b>第二参考面</b>	10mm±2mm SOF:Cw270°±1° from OF	10mm±2mm SOF:Cw315°±1° from OF	10mm±2mm SOF:Cw315°±1° from OF TOF:Cw270°±1° from OF
<b>厚度</b>	200~250±20um, 350±20um, 500±20um		
<b>传播表面</b>	"+" Ra面≤10Å		
<b>晶片背面</b>	GC#1000 研磨/蚀刻, GC#2000 研磨/蚀刻		
<b>总体厚度差</b>	≤5um		
<b>局部厚度差</b>	≤0.5um 在5*5mm区域内		
<b>厚度变化百分比</b>	≥95%(去除边缘3mm)		
<b>弯曲度</b>	-25um≤Bow≤+25um		
<b>居里温度</b>	603°C±2°C (DTA 方法)		
<b>边缘倒角</b>	倒角		

\* 以上参数仅供参考  
\* 特殊规格按照客户要求定制

# SAW Grade LiNbO<sub>3</sub> (LN) Wafer

## Application:

### SAW Devices

- ▶ Providing various LN wafers for SAW and BAW fabrications.
- ▶ Key properties influencing the yield of SAW devices are examined.
- ▶ And our patented product-low static black or gray LN wafers, are also available.

<b>Orientation</b>	64°rot. Y-cut±0.2°	127.86°rot. Y-cut±0.2°	Y-cut±0.2°
<b>Diameter</b>	76.2±0.2mm	100.0±0.2mm	150.0±0.2mm
<b>Orientation Flat (OF)</b>	22±2mm, 32±2mm, 47.5±2mm Perpendicular to X±0.2°		22±2mm, 32±2mm, 47.5±2mm Perpendicular to Z±0.2°
<b>Second Refer Flat (RF)</b>	10mm±2mm SOF:Cw180°±1° from OF	10mm±2mm SOF:Cw225°±1° from OF	10mm±2mm SOF:Cw270°±1° from OF TOF:Cw225°±1° from OF
<b>Thickness</b>	500±20um, 350±20um, 200~250±20um		
<b>Propagating Surface</b>	"+" side Ra≤10Å		
<b>wafer Backside</b>	GC#1000 lapped/ etched, GC#2000 lapped/ etched		
<b>TTV</b>	≤5um		
<b>LTV</b>	≤0.5um within an area of 5*5mm		
<b>PLTV</b>	≥95%(3mm from edge excluded)		
<b>BOW</b>	-25um≤Bow≤+25um		
<b>Curie Temperature</b>	1142°C±3°C (DTA method)		
<b>Edge Beveling</b>	Edge grinding		

\* The above index are for reference  
\* Other specifications could be customized

# 声表面波级铌酸锂晶片



## 应用领域:

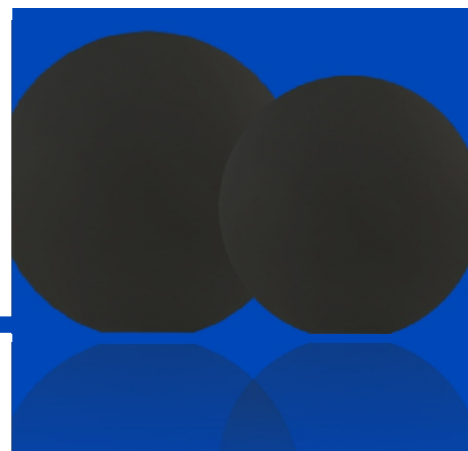
### 声表面波器件

- ▶ 提供适用于SAW和BAW器件制作要求的各种LN晶片。
- ▶ 影响SAW器件成品率的关键指标会被逐项检查。
- ▶ 亦可供应我们的专利技术产品-低静电黑色或灰色LN晶片。

<b>轴向</b>	64°rot. Y-cut±0.2°	127.86°rot. Y-cut±0.2°	Y-cut±0.2°
<b>直径</b>	76.2±0.2mm	100.0±0.2mm	150.0±0.2mm
<b>基准面</b>	22±2mm, 32±2mm, 47.5±2mm 垂直于 X±0.2°		22±2mm, 32±2mm, 47.5±2mm 垂直于 Z±0.2°
<b>第二参考面</b>	10mm±2mm SOF:Cw180°±1° from OF	10mm±2mm SOF:Cw225°±1° from OF	10mm±2mm SOF:Cw270°±1° from OF TOF:Cw225°±1° from OF
<b>厚度</b>	500±20um, 350±20um, 200~250±20um		
<b>传播表面</b>	"+" Ra面≤10Å		
<b>晶片背面</b>	GC#1000 研磨/蚀刻, GC#2000 研磨/蚀刻		
<b>总体厚度差</b>	≤5um		
<b>局部厚度差</b>	≤0.5um 在5*5mm区域内		
<b>厚度变化百分率</b>	≥95%(去除边缘3mm)		
<b>弯曲度</b>	-25um≤Bow≤+25um		
<b>居里温度</b>	1142°C±3°C (DTA 方法)		
<b>边缘倒角</b>	倒角		

\* 以上参数仅供参考  
\* 特殊规格按照客户要求定制

# Black-LT Black-LN



## Special Features

- ▶ High ability of electrical charge neutralization. Black-LT and Black-LN wafers shall neutralize the instantaneous electrical charge.
- ▶ Black-LT and Black-LN shall have no difference at piezoelectric properties from usual LT and LN wafers.
- ▶ High uniformity of Bulk resistivity throughout the surface and depth of wafers.
- ▶ Bulk resistivity shall be voluntarily controllable at each level (1.0E+10~9.0E+11 Ω\*cm).

## Specification of Bulk resistivity, Bulk conductivity

### Black-LT

	Standard Black	Super Black
Bulk resistivity (Ω·cm)	0.9E+11~9.9E+11	1.0E+11~9.9E+10
Bulk conductivity (Ω <sup>-1</sup> ·cm <sup>-1</sup> )	1.11E-11~1.11E-12	1.0E-10~1.11E-11

### Black-LN

	Standard Black
Bulk resistivity (Ω·cm)	1.0E+10~9.9E+10
Bulk conductivity (Ω <sup>-1</sup> ·cm <sup>-1</sup> )	1.00E-10~1.00E-11

## Typical Specifications

### Black-LT Wafers

Orientation	Diameter	Thickness	Surface Finish (+)plane (-)plane	
36° Y-cut 38.7° Y-cut 42° Y-cut 48° Y-cut X-112° Y-cut	150.0(mm) 100.0(mm)	0.20(mm) 0.25(mm) 0.35(mm) 0.50(mm)	Mirror Polished	GC#1000 GC#2000

### Black-LN Wafers

Orientation	Diameter	Thickness	Surface Finish (+)plane (-)plane	
Y-Zcut 41° Y-cut 64° Y-cut 127.86° Y-cut	150.0(mm) 100.0(mm)	0.20(mm) 0.25(mm) 0.35(mm) 0.50(mm)	Mirror Polished	GC#1000 GC#2000

## Specification of Bulk resistivity, Bulk conductivity

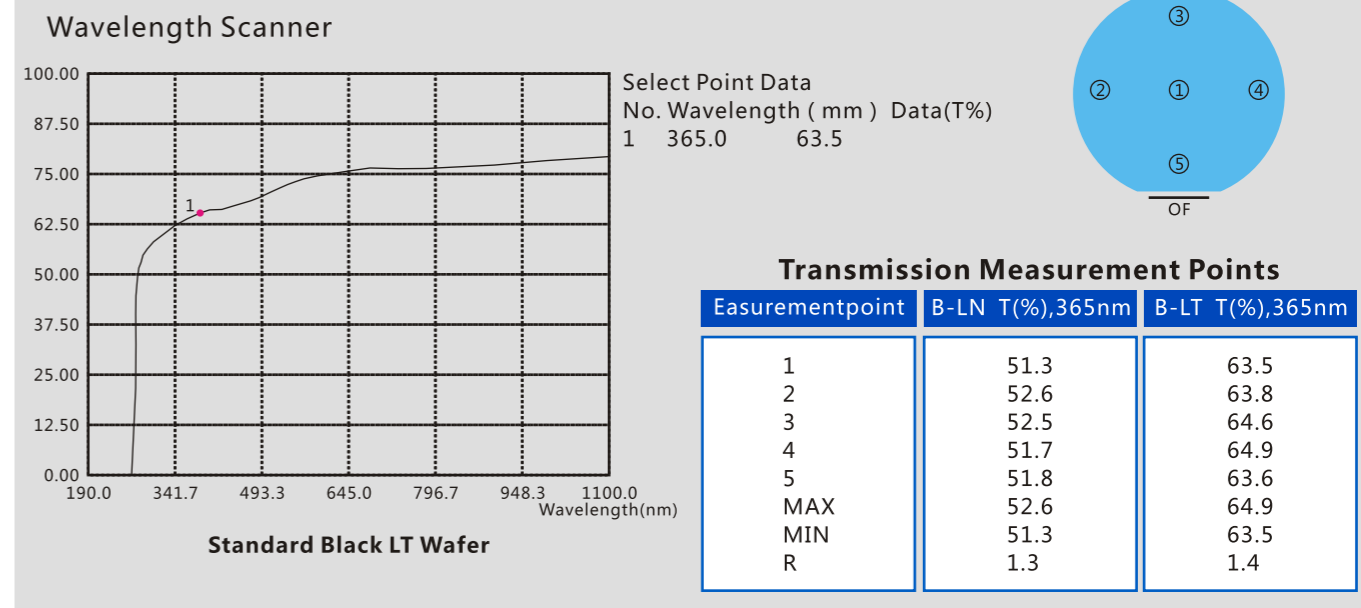
Black-LT Wafers	Black-LT		Usual LT	Black-LT	Usual LN
	Standard Black	Super Black		Standard Black	
Bulk resistivity (Ω·cm)	2.22*E+11	3.54E+10	1.90E+14	2.40E+10	1.20E+15
Bulk conductivity (Ω <sup>-1</sup> ·cm <sup>-1</sup> )	4.50E-12	2.80E-11	5.30E-15	4.17E-11	8.30E-16
Surface electric Potential* <sup>1</sup> /100mφ(kv)	< 0.40	< 0.10	4.12	< 0.05	3.05
Electrical charges neutralization(sec.)	3.7	1.5	∞	1.5	∞
Optical transmission(%)* <sup>2</sup>	65	< 60	72	< 60	73
Color	gray	dark gray	colorless	dark gray	colorless

\*1) electrical charges occurring with temperature raising from room temperature to 95, at 4 inch LT wafer (42° Y-cut, 0.35 mm thickness)

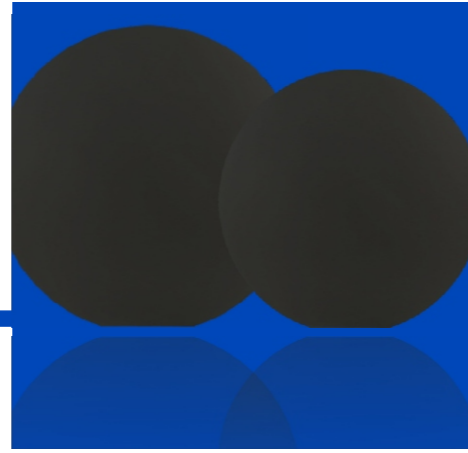
\*2)transmissivity of 0.35 mm thickness wafer (with both side mirror polished) measured by 365 nm wavelength

SAW Properties	LT 42° Y-cut		LN 127.86° Y-cut	
	LT	Black-LT	LN	Black-LN
Curie temp., Tc (°C)	603±2	603±2	1142±2	1142±2
SAW velocity	4022	Unchanged	3980	Unchanged
Coupling coefficient k <sup>2</sup>	7.6	Unchanged	5.5	Unchanged

## Optical Transmission Spectra



# 黑色钽酸锂晶片 黑色铌酸锂晶片



## 特性

- ▶ 中和电荷能力强。黑色LT和黑色LN可以中和任何迅速产生的瞬时电荷。
- ▶ 黑色LT和黑色LN的电压常数和普通LT和LN晶片没有区别。
- ▶ 从表面到内部的体电阻率均匀性一致。
- ▶ 体电阻率在每个等级都应被控制在(1.0E+10~9.0E+11 Ω\*cm)的水平。

## 体积电阻/电导率规格

### 黑色钽酸锂

	标准黑片	超级黑片
体积电阻率 (Ω·cm)	0.9E+11~9.9E+11	1.0E+11~9.9E+10
体积电导率 (Ω <sup>-1</sup> ·cm <sup>-1</sup> )	1.11E-11~1.11E-12	1.0E-10~1.11E-11

### 黑色铌酸锂

	标准黑片
体积电阻率 (Ω·cm)	1.0E+10~9.9E+10
体积电导率 (Ω <sup>-1</sup> ·cm <sup>-1</sup> )	1.00E-10~1.00E-11

## 典型规格

### 黑色钽酸锂晶片

晶向	直径	厚度	表面抛光 (+)平面 (-)平面	
36° Y-cut 38.7° Y-cut 42° Y-cut 48° Y-cut X-112° Y-cut	150.0(mm) 100.0(mm)	0.20(mm) 0.25(mm) 0.35(mm) 0.50(mm)	Mirror Polished	GC#1000 GC#2000

### 黑色铌酸锂晶片

晶向	直径	厚度	表面抛光 (+)平面 (-)平面	
Y-Zcut 41° Y-cut 64° Y-cut 127.86° Y-cut	150.0(mm) 100.0(mm)	0.20(mm) 0.25(mm) 0.35(mm) 0.50(mm)	Mirror Polished	GC#1000 GC#2000

## 体积电阻/电导率规格

黑色钽酸锂晶片	黑色钽酸锂晶片		常规	黑色标准 铌酸锂晶片	常规
	标准黑片	常规黑片			
体积电阻率 (Ω·cm)	2.22*E+11	3.54E+10	1.90E+14	2.40E+10	1.20E+15
体积电导率 (Ω <sup>-1</sup> ·cm <sup>-1</sup> )	4.50E-12	2.80E-11	5.30E-15	4.17E-11	8.30E-16
表面电势*1/100mq(kv)	<0.40	<0.10	4.12	<0.05	3.05
电荷中和	3.7	1.5	∞	1.5	∞
光学传输(%)*2)	65	<60	72	<60	73
颜色	灰色	深灰色	无色	深灰色	无色

\*1) 电荷发生在温度从室温上升到95°C的4英寸LT晶片 (42° Y-cut, 厚度为0.35 mm)

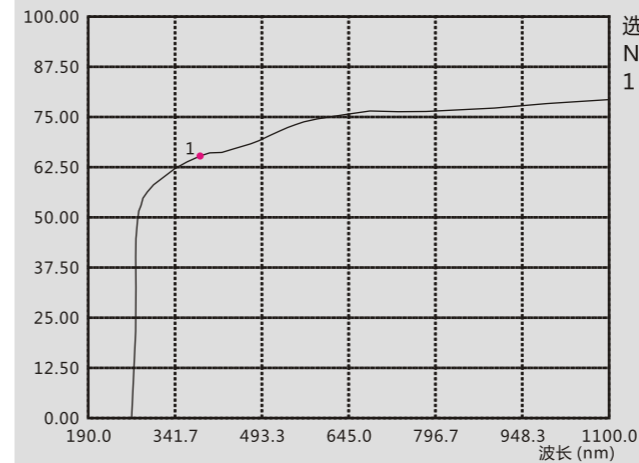
\*2) 用365nm的波长测试0.35mm厚度的晶片透射率 (双面镜面抛光)

## 声表面波性能

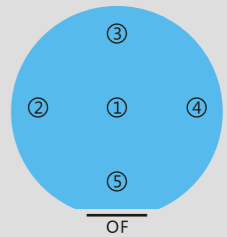
声表面波性能	钽酸锂 42° Y-cut		铌酸锂 127.86° Y-cut	
	钽酸锂	黑色钽酸锂	铌酸锂	黑色铌酸锂
居里温度 Tc (°C)	603±2	603±2	1142±2	1142±2
速率	4022	未改变	3980	未改变
机电耦合系数 k <sup>2</sup>	7.6	未改变	5.5	未改变

## 光学透射谱

### 波长扫描仪



选择点数据  
No. 波长 (nm) 数据(T%)  
1 365.0 63.5



### 透过率测量点

测量点	黑色钽酸锂 T(%),365nm	黑色铌酸锂 T(%),365nm
1	51.3	63.5
2	52.6	63.8
3	52.5	64.6
4	51.7	64.9
5	51.8	63.6
最大	52.6	64.9
最小	51.3	63.5
R	1.3	1.4

标准黑色钽酸锂晶片

# LT Crystal Features

Molecular Formula: LiTaO<sub>3</sub>/LT Molecular Weight: 235.8871

Properties Chart 1

Crystal System		Trigonal System	Density Crystallinity (g/cm <sup>3</sup> )	7.4564
Lattice Constant(nm)		a=0.515428, c=1.378351	Moh's Hardness	5.5
Point Group	High Temperature Phase	-3m	SAW Speed (m/s)	See Chart 2
	Low Temperature Phase	3m		
Cleavage Plane		(01T2)	Electromechanical Coupling Factor(K <sup>2</sup> /%)	See Chart 2
Melting Point ( °C )		1650	Temperature Coefficient10 <sup>-6</sup> /°C	See Chart 2
Pyroelectric Coefficient		23×10 <sup>-5</sup> C/(k·m2)	Relative Dielectric Constant	ε <sub>11</sub> =53.6, ε <sub>33</sub> =43.4
Curie Temperature ( °C )		603	Insoluble in acid except HF and HNO <sub>3</sub>	
Optical Transparency Range		350~5000 nm	Specific Heat ( Cal/K·cm <sup>3</sup> )	0.79
Refractive Index		n <sub>o</sub> = 2.180 , n <sub>e</sub> =2.176 @632.8nm		
Electro-optic Coefficient		r <sub>13</sub> =8.4pm/v, r <sub>33</sub> =30.5pm/V		
Nonlinear Optical Coefficient		d <sub>33</sub> =15.1pm/v@852nm	Piezoelectric Constant 10 <sup>-11</sup> C/N	D <sub>15</sub> =2.67, d <sub>33</sub> =0.57
Coefficient of Thermal Expansion (10 <sup>-6</sup> /°C(@25°C)		α <sub>11</sub> =16.1, α <sub>33</sub> =4.1	Heat Conductivity (w/cm·k)	0.05

Properties Chart 2

Cut Surface	X Plane	42°Y Plane	36°Y Plane
SAW Propagation Direction	112.2°Y-Direction	X-Direction	X-Direction
Electromechanical Coupling Coefficient K <sub>s</sub> <sup>2</sup> (%)	0.75	7.6	5
Temperature Coefficient of Delay Time T <sub>0t</sub> (ppm/°C)	-18	-40	-36
SAW Speed V <sub>s</sub> (m/s)	3296	4022	4178

\* The above index are for reference.

# 钽酸锂晶体基本性能

分子式：LiTaO<sub>3</sub>/LT 分子量：235.8871

性能表1

结晶系		三方晶系	结晶密度(g/cm <sup>3</sup> )	7.4564
晶格常数(nm)		a=0.515428, c=1.378351	莫氏硬度	5.5
点群	高温相	-3m	声表面波速度 (米/秒)	见性能表2
	低温相	3m		
解理面		(01T2)	机电耦合系数(K <sup>2</sup> /%)	见性能表2
熔点 ( °C )		1650	温度系数10 <sup>-6</sup> /°C	见性能表2
热释电系数		23×10 <sup>-5</sup> C/(k·m2)	相对介电常数	ε <sub>11</sub> =53.6, ε <sub>33</sub> =43.4
居里温度 ( °C )		603	不溶于除HF及HNO <sub>3</sub> 以外的酸	
透光波段		350~5000 nm	比热 ( Cal/K·cm <sup>3</sup> )	0.79
折射率		n <sub>o</sub> = 2.180 , n <sub>e</sub> =2.176 @632.8nm		
电光系数		r <sub>13</sub> =8.4pm/v, r <sub>33</sub> =30.5pm/V		
非线性光学系数		d <sub>33</sub> =15.1pm/v@852nm	压电常数10 <sup>-11</sup> C/N	D <sub>15</sub> =2.67, d <sub>33</sub> =0.57
热膨胀系数(10 <sup>-6</sup> /°C(@25°C)		α <sub>11</sub> =16.1, α <sub>33</sub> =4.1	热导率(w/cm·k)	0.05

性能表2

切割面	X面	42°Y面	36°Y面
声表面波传播方向	112.2°Y方向	X方向	X方向
机电耦合系数K <sub>s</sub> <sup>2</sup> (%)	0.75	7.6	5
延迟时间温度系数T <sub>0t</sub> (ppm/°C)	-18	-40	-36
声表面波速度V <sub>s</sub> (m/s)	3296	4022	4178

\* 以上参数仅供参考。



# LN Crystal Features

Molecular Formula: LiNbO<sub>3</sub>/LN Molecular Weight: 147.85

Properties Chart 1

Crystal System		Trigonal System	Density Crystallinity (g/cm <sup>3</sup> )	4.612
Lattice Constant(nm)		a=0.514829, c=1.38631	Moh's Hardness	5
Point Group	High Temperature Phase	-3m	SAW Speed (m/s)	See Chart 2
	Low Temperature Phase	3m		
Cleavage Plane		(01T2)	Electromechanical Coupling Factor(K <sup>2</sup> /%)	See Chart 2
Melting Point ( °C )		1260	Temperature Coefficient10 <sup>-6</sup> /°C	See Chart 2
Pyroelectric Coefficient		-4×10 <sup>-5</sup> C/(k·m2)	Relative Dielectric Constant	ε <sub>11</sub> =85.2, ε <sub>33</sub> =28.7
Curie Temperature ( °C )		1142	Insoluble in acid except HF and HNO <sub>3</sub>	
Optical Transparency Range		400~5000 nm	Specific Heat ( Cal/K·cm <sup>3</sup> )	0.76
Refractive Index		n <sub>o</sub> = 2.286 , n <sub>e</sub> =2.202 @632.8nm		
Electro-optic Coefficient		r <sub>13</sub> =9.6pm/v, r <sub>33</sub> =30.9pm/V		
Nonlinear Optical Coefficient		d <sub>33</sub> =33pm/v@852nm	Piezoelectric Constant 10 <sup>-11</sup> C/N	D <sub>15</sub> =6.8, d <sub>33</sub> =0.6
Coefficient of Thermal Expansion (10 <sup>-6</sup> /°C(@25°C)		α <sub>11</sub> =15.4, α <sub>33</sub> =7.5	Heat Conductivity (w/cm·k)	0.029

Properties Chart 2

Items	Index	
SAW Speed V <sub>s</sub> (m/s)	( Rotate128°Y-X ) : 3950/3990	( Y-Z ) : 3470/3510
SAW Electromechanical Coupling Coefficient K <sub>s</sub> <sup>2</sup> (%)	( Rotate128°Y-X ) : 5.4~6.0	( Y-Z ) : 4.1~4.6
Temperature Coefficient of SAW Delay Time T <sub>0</sub> t(ppm/°C)	( Rotate128°Y-X ) : 73~78	( Y-Z ) : 91~97
Temperature Coefficient of SAW Speed T <sub>0</sub> V(ppm/°C)	( Rotate128°Y-X ) : -57~-61	( Y-Z ) : -84~-90

\* The above index are for reference.

# 铌酸锂晶体基本性能

分子式：LiNbO<sub>3</sub>/LN 分子量：147.85

性能表1

结晶系		三方晶系	结晶密度(g/cm <sup>3</sup> )	4.612
晶格常数(nm)		a=0.514829, c=1.38631	莫氏硬度	5
点群	高温相	-3m	声表面波速度 (米/秒)	见性能表2
	低温相	3m		
解理面		(01T2)	机电耦合系数(K <sup>2</sup> /%)	见性能表2
熔点 ( °C )		1260	温度系数10 <sup>-6</sup> /°C	见性能表2
热释电系数		-4×10 <sup>-5</sup> C/(k·m2)	相对介电常数	ε <sub>11</sub> =85.2, ε <sub>33</sub> =28.7
居里温度 ( °C )		1142	不溶于除HF及HNO <sub>3</sub> 以外的酸	
透光波段		400~5000 nm	比热 ( Cal/K·cm <sup>3</sup> )	0.76
折射率		n <sub>o</sub> = 2.286 , n <sub>e</sub> =2.202 @632.8nm		
电光系数		r <sub>13</sub> =9.6pm/v, r <sub>33</sub> =30.9pm/V		
非线性光学系数		d <sub>33</sub> =33pm/v@852nm	压电常数10 <sup>-11</sup> C/N	D <sub>15</sub> =6.8, d <sub>33</sub> =0.6
热膨胀系数(10 <sup>-6</sup> /°C(@25°C)		α <sub>11</sub> =15.4, α <sub>33</sub> =7.5	热导率(w/cm·k)	0.029

名称	指标	
声表面波速度V <sub>s</sub> (m/s)	( 旋转128°Y-X ) : 3950/3990	( Y-Z ) : 3470/3510
声表面波机电耦合系数K <sub>s</sub> <sup>2</sup> (%)	( 旋转128°Y-X ) : 5.4~6.0	( Y-Z ) : 4.1~4.6
声表面波延迟时间温度系数T <sub>0</sub> t(ppm/°C)	( 旋转128°Y-X ) : 73~78	( Y-Z ) : 91~97
声表面波速度温度系数T <sub>0</sub> V(ppm/°C)	( 旋转128°Y-X ) : -57~-61	( Y-Z ) : -84~-90

# Processing Equipment

生产设备

