



Leading Manufacturer of Crystals and Optics for Laser Applications

福建福晶科技股份有限公司

产品使用说明书V1.0

User's Manual

感谢您选用我们公司产品。

Thank you for using CASTECH's products.

福建福晶科技股份有限公司（福晶科技），总部位于福建省福州市。主要从事非线性光学晶体、激光晶体和激光光学元器件的研发、生产和销售，其产品广泛应用于激光及光通讯领域。公司于2008年3月19日在深交所中小企业板上市（股票代码002222）。

Fujian CASTECH Crystals INC. is located in Fuzhou city, Fujian Province, in China. It is devoted to the development, manufacturing and marketing of nonlinear optical crystals, laser crystals and laser optics. CASTECH's products are widely used in the fields of laser and optical communication. In Mar.19, 2008 CASTECH went public in The Shenzhen Stock Exchange (Stock Code 002222).

近二十年的创业历程，公司逐步发展了熔盐法，提拉法和水溶液法等多种晶体生长技术，开发了IAD, IBS, E-Beam等多种镀膜制备工艺，以适应不同的应用需求。此外，公司的检测技术和设备也处于业界领先地位，拥有Zygo, Nikon, Trioptics等各类先进检测仪器。公司于2001年通过了ISO9001质量体系认证；并于2006年7月，将欧盟RoHS (Restriction of Hazardous Substance Directive) 标准 (2005/95/EC) 引入制造过程，确保销售的所有晶体、光学元件均符合绿色环保规定。

After twenty years untiring effort, CASTECH has developed flux, Czochralski and water solution crystal growing technology. We have IAD, IBS and EB coating techniques to meet different requirements. A whole set of crystal inspection and manufacturing controlling equipments including Zygo, Nikon, Trioptics ensures that every piece of CASTECH's product are carefully inspected. In 2001, CASTECH got the ISO 9001 certification, and in July 2006, the EU RoHS (Restriction of Hazardous Substance Directive) standard (2005/95 / EC) was introduced to the manufacturing process, which ensure that all of the products meet the RoHS requirements.

公司产品80%以上出口美、日、德等国家和其他地区，深受国际业界的广泛推崇，被盛誉为“中国牌晶体”。今天的福晶将朝着“成为非线性光学晶体和激光晶体的最佳全球供应商”的目标而努力。

Over 80% of CASTECH's products are exported to the USA, Japan, Germany and other countries and districts, and are praised as "China Crystal". Today CASTECH will work towards the goal of becoming the best global supplier for non-linear optical crystal and laser crystals.

再次感谢您对福晶公司的关注，希望您能一如既往地支持我们的发展。请您在产品使用前，详细阅读本产品说明书。

Thank you again for your cooperation. We hope you will continue to support us. Please read all of the product instructions in detail before using our products.

谢发利
Fala bic

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免责声明：

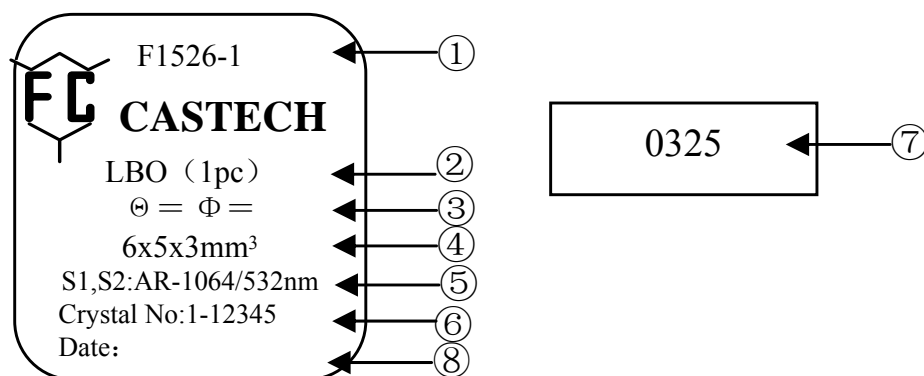
- (1) 本产品说明书是本公司技术人员根据产品的特性进行编写，帮助用户更方便地使用本公司的产品。
- (2) 使用者应具备激光，光学等方面的基本知识，以及激光器制造和相关产品制造的知识，本公司不能保证按本说明书的要求就一定能制造合格的下游产品。
- (3) 本说明书并未包括全部的使用者应注意的事项，使用者在使用过程还应注意电，水，声，光等方面对产品，人体的影响和损伤。
- (4) 使用者在制造相关产品时有可能需要比本说明书更严格的使用条件。
- (5) 使用者收到的产品标识若与本说明书有所不同并不代表其为不合格产品。

Disclaimer Statement:

- (1) This User's Manual was prepared by CASTECH's Technicians according to the product's characteristic. We intend to help the users to use our products more convenient.
- (2) The users should have knowledge of laser and optics, and are familiar with the laser manufacturing and related product manufacturing.
- (3) This User's Manual doesn't include all of the notes that the users should pay attention to. The user should avoid the influence and hurt by electricity, water, noise, strong light, etc. during assemble process.
- (4) The users may need more strict control when you manufacture different product.
- (5) It doesn't mean unqualified product if the product you receive has different mark with this User's Manual.

产品标签(Label) ■ ■ ■

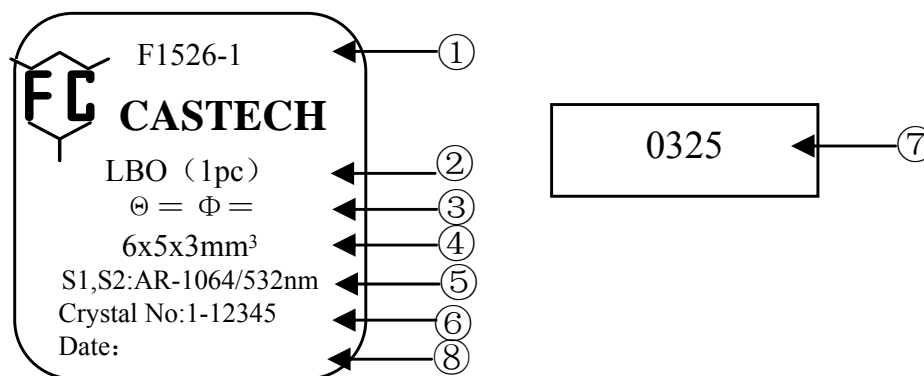
晶体产品标签示例：



①-加工批次	⑤-表面镀膜
②-产品名称及数量	⑥-产品代码
③-定向角度	⑦-产品流水号
④-产品尺寸	⑧-生产日期

上述示例含义：表示LBO晶体，定向角度为（ $\Theta = \Phi =$ ），镀AR-1064/532nm增透膜，产品编号为1-12345-0325。

Example of Crystal Product:

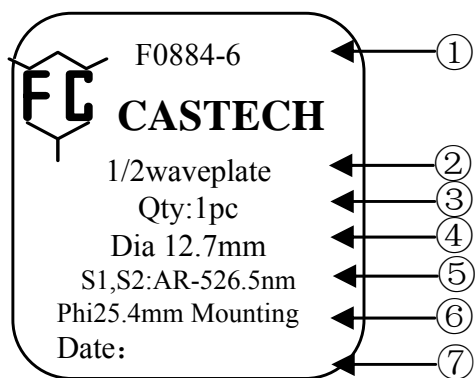


①-Batch No.	⑤-Coating
②-Products and quantity	⑥-ID
③-Orientation	⑦-Serial Number
④-Dimensions	⑧-Manufacturing Date

Meaning: LBO, cut angle is ($\Theta = \Phi =$), with coating AR-1064/532nm, Serial NO. is 1-12345-0325.



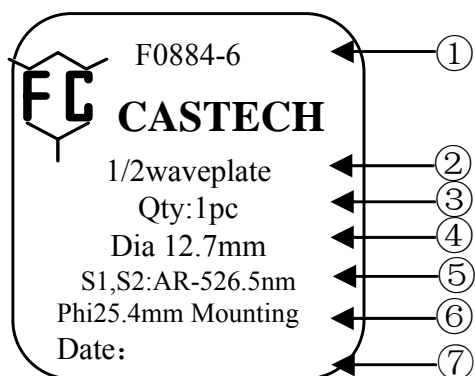
光学产品标签示例:



①-加工批次	⑤ -表面镀膜
②-产品名称	⑥ -装支架情况
③-数量	⑦-生产日期
④ -产品尺寸	

上述示例含义: 表示1/2波片, 镀AR-526.5nm增透膜, 装直径为25.4mm的支架

Example of Optical products:



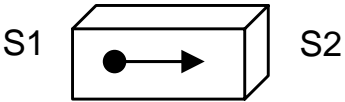
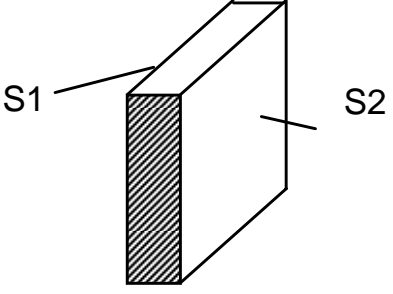
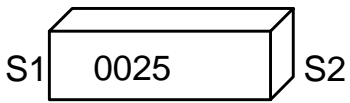
①-Batch No.	⑤ -Coating
②-Products	⑥ -Mounting
③-Quantity	⑦- Manufacturing Date
④ -Dimensions	

Meaning: 1/2 waveplate with coating AR-526.5nm, Phi25.4mm mounting.

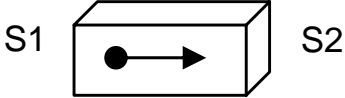
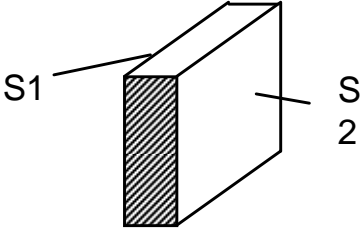
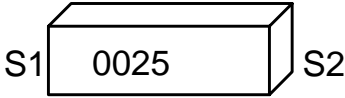
产品标记 (Mark) ■ ■ ■

您收到的产品上可能有如下标记，下面给您简单介绍福晶公司通用标记含义。如您订单上已有指定的标记要求，您可以跳过这一段。

If you have already specified mark requirements in your orders, you may skip this section. If you haven't specified please refer to our regular standard as follows.

分类	图示说明
$T^* \geq 2.5\text{mm}$	<p>“•→”：由“•” + “→”组成。</p> <p>“•”打点：表示晶体的调谐旋转轴方向，与标记面垂直。</p> <p>“→”箭头：通光方向，S1 指向 S2 面。</p> 
$T \leq 2.5\text{mm}$	<p>垂直于标记面（涂黑）的为调谐旋转轴方向。</p> 
产品编号	<p>对于厚片产品 ($T \geq 4\text{mm}$)，通常会如图所示标上产品编号</p> 

*: T表示产品通光长度

Type	Description
<p>$T^* \geq 2.5\text{mm}$</p>	<p>“●→”: “●” + “→”</p> <p>“●”: The marked surface is perpendicular to the tuning axis.</p> <p>“→”Orientation: S1 to S2 (along the beam path) .</p> 
<p>$T < 2.5\text{mm}$</p>	<p>The blackened surface is perpendicular to the tuning axis.</p> 
<p>Serial number</p>	<p>For the thick crystal ($T \geq 4\text{mm}$), the serial number (eg.0025) will be marked on the side face as shown in the diagram.</p> 

*: T means thickness of product.

晶体轴向(Crystal Axis) ■ ■ ■

晶类	角度	标记面及内容	
LBO	$\theta=90^\circ$ Φ 任意 (I类)	Z面* (X轴指向右上角)	
	θ =任意 $\Phi=90^\circ$ (II类)	X面* (Z轴指向右上角)	
	θ =任意 $\Phi=0^\circ$ (I或II类)	Y面* (Z轴指向右上角)	
BBO	θ =任意 $\Phi=0^\circ$ (I类)	Y面 (Z轴指向右上角)	
	θ =任意 $\Phi=30^\circ$ (II类)	X面 (Z轴指向右上角)	
YVO ₄	a-cut ($\theta=90^\circ\Phi=0^\circ$)	标记面为c面。 “→”表示S1指向S2。如图：	
	$\theta=90^\circ$ $\Phi=45^\circ$	光轴在通光面内如图， 黑色箭头在侧面且靠近S2面。	
	$\theta=45^\circ$ $\Phi=0^\circ$	标记面为 a 面，“→”为光轴方向。具体如图：	
		T > 2.5mm	T ≤ 2.5mm
	c-cut	标记面为 a 面。“→”表示S1指向S2。如图：	

(* X,Y,Z面分别表示垂直于晶体光学轴X,Y,Z轴的平面)

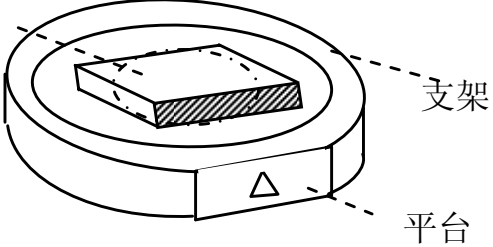
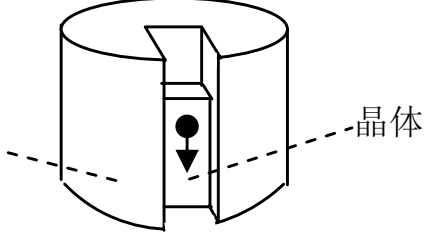
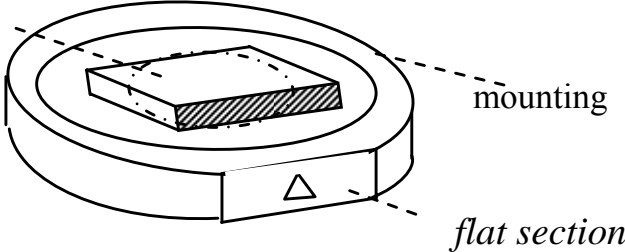
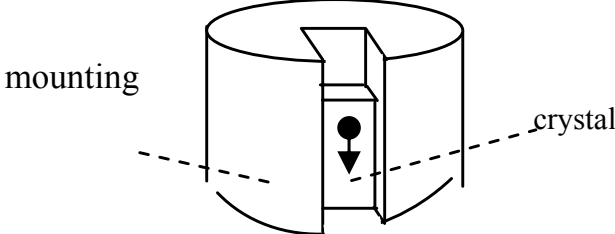
晶体轴向(Crystal Axis)

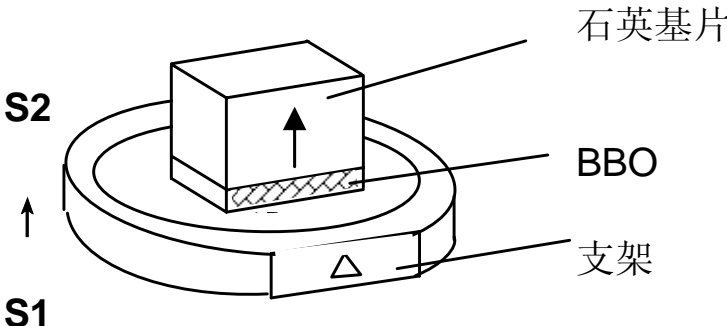
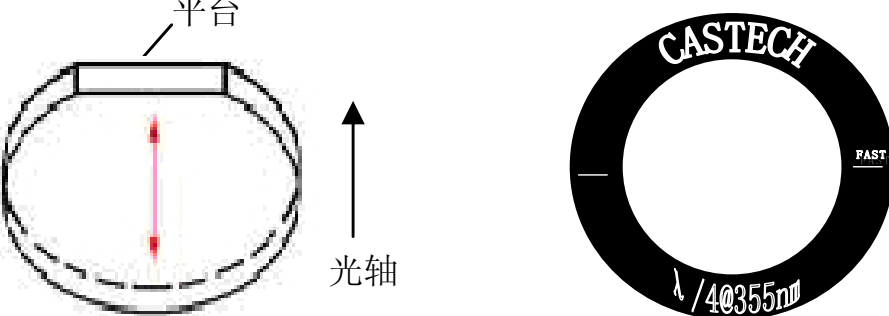
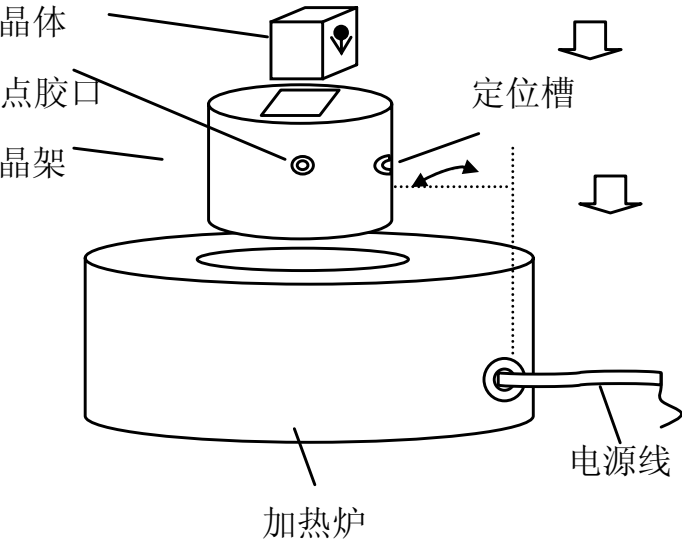
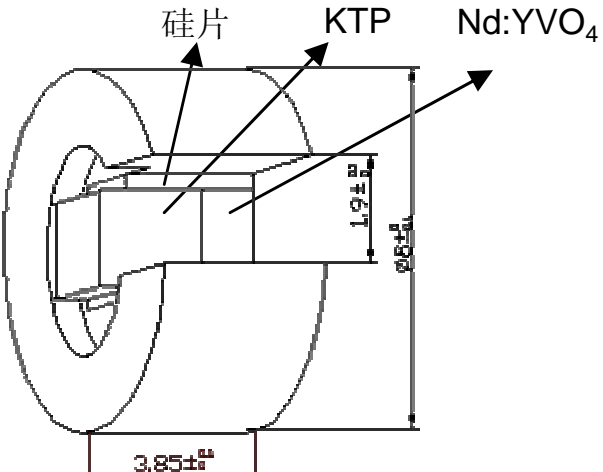
Crystal	Cut angle	Mark and Meanings		
LBO	$\theta=90^\circ$ Φ (Type I)	Mark on * Z surface (X-axis point to top right)		
	θ $\Phi=90^\circ$ (Type II)	Mark on *X surface (Z-axis point to top right)		
	θ $\Phi=0^\circ$ (Type I or Type II)	Mark on * Y surface (Z-axis point to top right)		
BBO	θ $\Phi=0^\circ$ (Type I)	Mark on Y surface (Z-axis point to top right)		
	θ $\Phi=30^\circ$ (Type II)	Mark on X surface (Z-axis point to top right)		
YVO ₄	a-cut ($\theta=90^\circ\Phi=0^\circ$)	Mark on c surface “→”indicate S1 to S2		
	$\theta=90^\circ$ $\Phi=45^\circ$	Optical axis lie on the surface S1 or S2. “↑” mark is close to S2.		
	$\theta=45^\circ$ $\Phi=0^\circ$	Mark on surface a, “→”indicate optical axis:		
		$T > 2.5\text{mm}$	$T \leq 2.5\text{mm}$	 <p>The optical axis lie on the shadow surface (a).</p>
c-cut	Mark on surface a, “→” indicate S1 to S2.			

*Surface X,Y,Z is perpendicular to the crystal's optical axis.

晶体轴向(Crystal Axis)

各种支架标识 (Holders) ■ ■ ■

<p>常规支架</p>	<p>装支架的晶体, 标记面正对着支架的平台或凹槽; 晶体的调谐旋转轴方向垂直于平台或凹槽。</p> <p>$T < 3\text{mm}$ 薄片支架: 晶体</p> <p>“▷”, 表示S1 指向 S2 面。</p>  <p>$T \geq 3\text{mm}$ 厚片支架: 支架</p> 
<p>Standard mounting</p>	<p>When a crystal is mounted in a holder, we set the marked face against the flat section (thin) or the notch (thick), which is perpendicular to the tuning axis.</p> <p>$T < 3\text{mm}$ <i>thin crystal</i>:</p> <p>“▷”: S1 to S2 . crystal</p>  <p>$T \geq 3\text{mm}$ <i>thick crystal</i>:</p> 

<p>贴石英基片的BBO晶体</p>	<p>BB0在S1面端，石英基片在S2面端。</p> 
<p>波片支架</p>	<p>波片平台和支架的快轴标记平行。</p> 
<p>温控炉支架</p>	<p>晶体标记面紧贴定位槽面； 晶架定位槽、加热炉内定位卡与电源线相对；</p> 
<p>胶合支架</p>	<p>开口面平行于Nd:YVO₄晶体的a面</p> 

各种支架标识(Holders)

<p>BBO with fused silica substrate</p>	<p>S1 :BBO S2: fused silica</p> <p>substrate</p> <p>BBO</p> <p>holder</p>
<p>Waveplate mounting</p>	<p>The platform is parallel to the fast axis</p> <p>platform parallel</p> <p>axis</p>
<p>Oven and holder</p>	<p>The marked surface faces the positioning and power lines.</p> <p>crystal</p> <p>dispensing hole</p> <p>holder</p> <p>Oven</p> <p>Positioning</p> <p>Power line</p>
<p>Mounting of glued Crystals (Nd:YVO4+KTP)</p>	<p>Nd:YVO₄ a surface faces the notch of the holder.</p> <p>Si</p> <p>KTP</p> <p>Nd:YVO₄</p>

各种支架标识(Holders)

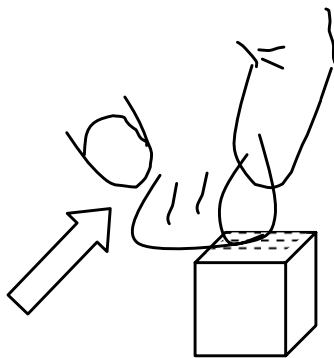
产品使用

- ◆ 请在干燥和清洁的环境内打开包装盒。
 - ※环境温度：23±2°C
 - ※环境湿度：≤55%
 - ※以上是指产品装配时的环境要求,并非指激光腔内环境。实际腔内要求应高于此以确保您的激光系统的使用寿命。尤其是使用易潮晶体如LBO, BBO, KD*P等晶体时,应确保腔内的环境干燥、密封、清洁,建议腔内湿度应小于15%。
- ◆ 使用晶体(光学品)时,须指定专人操作。操作过程中手指、油脂或其他任何物体不可触碰抛光或镀膜表面,避免污染和损坏晶体表面。
- ◆ 包装盒开启:

首次使用时剪掉塑料包装袋,取出塑料包装盒。然后沿塑料包装盒四角顺序慢慢打开盒子,应该特别注意小心打开盒盖,避免晶体(光学品)掉落(晶体(光学品)在运输过程可能吸附在盒盖上);同时切忌用力拔出盒盖,以免晶体(光学品)弹出崩裂。
- ◆ 晶体(光学品)夹取:

可使用碳素镊子或戴指套夹取晶体(光学品)未抛光或镀膜的侧面;不建议使用金属镊子,以免夹崩或刮伤晶体。
- ◆ 晶体(光学品)表面清洁:

可先用洗耳球轻吹晶体(光学品)表面灰尘或大的污物。如仍然有脏污,可使用乙醚和乙醇的混合液(配比1:1),滴少许于脱脂棉或折叠的绸布上清洁晶体表面:注意擦拭面要平整,擦拭力度要轻、均匀;擦拭的时候从表面边缘的一端的到另一端,且擦拭一次后,应更换棉球或绸布的位置,以免造成二次污染和破坏。如您仍有困难清除表面污染,请致电: [0591-83710533](tel:0591-83710533) 或通过sales@castech.com 与我们联系,我们将尽快为您提供处理方案。



建议晶体(光学品)尽可能在空气中的暴露时间不超过30分钟,未使用时请注意保存环境,具体保存方法,请参见产品储存3

Products Instruction ■ ■ ■

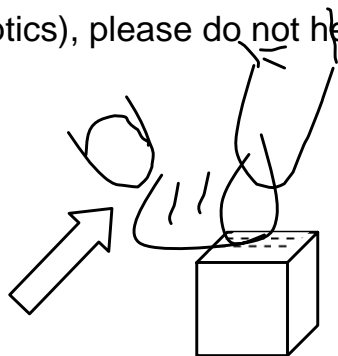
Once the inner plastic box has been opened, CASTECH's engineer recommends to provide a dry and clean environment.

Temperature: $23 \pm 2^{\circ}\text{C}$

Humidity: $\leq 55\%$

The above conditions are required for product assemble process. The conditions in your laser system should be more strict than those to ensure long lifetime of your laser system. Especially when using the deliquescence crystals such as LBO, BBO, DKDP etc, please ensure that the cavity environment is dry, sealed, clean and the humidity had better than 15%.

- ◆ It is recommended that only qualified personnel can open the inner plastic boxes. Finger prints, oil and other substances should not contact the polished or coated surfaces directly.
- ◆ Package opening instructions:
Please cut the plastic bags and remove the plastic packaging. Once this has been done, carefully open the box along the four corners of the plastic packaging, paying special attention to opening the lid to avoid the crystal (optics) falling (it may be adhere to the lid during transportation); at the same time do not force open the lid to avoid breaking the crystal (optics) inside.
- ◆ Instructions of clamping the crystals (optics):
Using carbon tweezers or wearing a fingerstall to clamp the crystal (optics) without touching the polished or coating surfaces. The use of metal tweezers is not recommended to avoid breaking or scratching the crystals (optics).
- ◆ Instructions of cleaning the crystals (optics):
If the surfaces are contaminated, an air ball is recommended to blow on the surfaces. If there is still contamination on the crystal (optics) surfaces, please clean the surfaces with cleaning liquid and soft silk. We recommend using a mixing liquid of 50% high purity alcohol and 50% high purity ether. If you can not clean the crystal(optics), please do not hesitate to contact us.



- ◆ We suggest that do not expose the crystals (optics) to the air for more than thirty minutes if possible. Please refer to STORAGE sections for more details.

以下各类晶体产品的应用及注意事项：

非线性光学晶体：



- 1) 使用前，为确保使用效果，请先确定您使用的激光峰值功率低于晶体的损伤阈值。
- 2) 请您根据晶体的相位匹配类型和基频光的偏振方向选择正确的方位安装晶体，并小心调节角度。
- 3) 尽量避免碰触晶体的光学表面。如一定要清洁，请尽量由专业的擦拭人员操作，否则易造成晶体表面的损伤。
- 4) 保存应用于紫外波段的晶体时，不能使用含Si元素的包装盒。
- 5) 晶体使用时，升降温速率要求控制小于3℃/分，以免晶体和膜层开裂；
- 6) 注意装配夹紧力度，力度过大会造成晶体开裂；
- 7) 对光时，注意激光在晶体出入射面的中心位置。如果激光打到晶体侧面，容易产生挥发物污染工作腔或晶体开裂现象；

USE of Nonlinear Optical Crystals:

- 1) Please make sure your laser power density is under the damage threshold of crystals.
- 2) Please install the crystals according to the crystal phase-matching type and polarization directions of fundamental lasers, and carefully adjust the crystal along the tuning angle.
- 3) Please avoid directly touching the crystal surface. If the surface need cleaning, it should be done by professional staff according to the cleaning manual.
- 4) For crystals used in UV band, it is important not to use package containing silicon (Si) element.
- 5) A heating and cooling rate of less than 3 °C / min is needed to avoid the crystal or the coating film cracking.
- 6) Handling carefully during assembly, too strong pressure may cause the cracking of crystal.
- 7) Align the laser beam to the middle of the crystal. If the laser beam hits the side of the crystal, it may volatile something and cause pollution of the laser cavity and damage the crystal surface.

激光晶体:



1. 请确认您使用的泵浦光源的波长和激光晶体的峰值吸收波长一致。
2. 在安装 Nd:YVO₄, Nd:GdVO₄等有偏振吸收性质的晶体时,请确认泵浦光源的偏振方向与晶体的最大吸收偏振方向一致。

(晶体的升降温速率、夹紧力度、对光要求, 请参阅“非线性晶体”5) -7))

Laser Crystal



1. Ensure that the pumping wavelength is consistent with the absorption wavelength of the laser crystal.
2. When installation birefringent laser crystal such as Nd: YVO₄ or Nd: GdVO₄, it is important to make sure the polarization direction of the pump source is along the maximum absorption direction of the laser crystal.

(For information about crystal heating and cooling rates, the handling of crystal and alignment of laser beam requirements, please refer to “nonlinear crystal” 5-7)



绿光蓝光晶体组件:



1. 请确认泵浦光源的波长和激光晶体的峰值吸收波长是否一致;泵浦光的偏振方向与激光晶体的最大吸收偏振方向是否一致.
2. 建议您在500mW泵浦功率以下使用光胶晶体。
3. 请确保各晶体在工作时散热良好。

晶体的升降温速率、夹紧力度、对光要求, 请参阅“非线性晶体”5) -7))

Green and blue Laser Kit



1. Make sure that the wavelength of pumping light is consistent with the absorption wavelength of the laser crystal.
2. It is recommended that the pumping power should be under 500 mW for green laser kit.
3. Ensure that when the crystals are in use, they are well cooled.

(For information about crystal heating and cooling rates, the handling of crystal and alignment of laser beam requirements, please refer to “nonlinear crystal” 5-7)

产品储存 ■ ■ ■

1. 晶体(光学品)放入包装盒:
晶体(光学品)使用后,应充分清洁,然后放入包装盒,同时要求通光面非接触包装,严防通光面划伤或脏污;包装务必做到密封、洁净、防潮、防震、防静电、抗冲击。
2. 晶体(光学品)在未使用时,应储存在干燥皿里,也可在真空包装里使用干燥剂,以防晶体(光学品)受潮而影响使用。
3. 存放环境应恒温(环境温度 $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$)、干燥(相对湿度应不大于20%)、洁净(维持在1000级)的容器(或干燥器)内。

Storage

1. Crystals (optics) should be well cleaned after use and placed into the box. At the same time non-contact packaging is required to prevent scratches or smudges on the two light passing surfaces. Ensure that the packaging is sealed, neat, moisture-proof, shockproof and anti-static.
2. Crystals (optics) should be stored under dry condition. They can be kept in vacuum packaging with desiccant to prevent from humidity and affects its normal function.
3. The recommended storage conditions; temperature $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$, humidity $< 20\%$, clean (maintained at 1000), and isolated.

售后服务 ■ ■ ■

如对产品在使用及调试中有任何疑问，请致电并告知如下信息：

1. 您的订单号
2. 加工批次
3. 产品编号
4. 您的使用条件,包括激光工作条件

我们将尽快为您提供解决方案。

客户如需定制产品，请提供激光器的主要性能参数，如脉冲能量，脉冲宽度，脉冲重复频率，连续光能量，光束直径，模式条件，发散角，可调波长范围等。

福建福晶科技股份有限公司

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邮编: **350002**

地址: 福建省福州市杨桥西路**155**号

Service

If you have any questions with testing and debugging, please contact us without hesitate and provide information including PO No., the batch no. and the serial number on the packaging box or on the side face. We will seek to provide professional solutions for you as soon as we can.

When you order special crystals or optics, please inform us with the main parameters of the laser, such as pulse energy, pulse width, repetition rate, continuous power, beam diameter, beam mode, beam divergence and tunable wavelength range.

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PO Box 143

Fuzhou

Fujian 350002

P.R.China

附录 ■ ■ ■

对于随机的标准件、附件、备件以及技术文件等以附录形式加以说明。

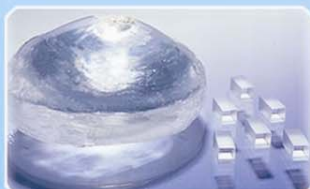
Appendix

The introduction of standardized elements, spare parts, technical documents etc. is covered in the appendix.

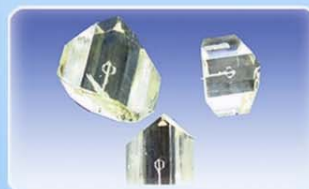
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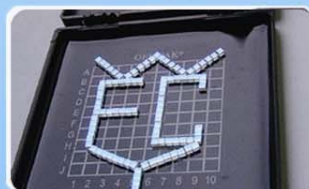
KTP



Nd:YVO4



OPTICS



THIN FILM FILTERS

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