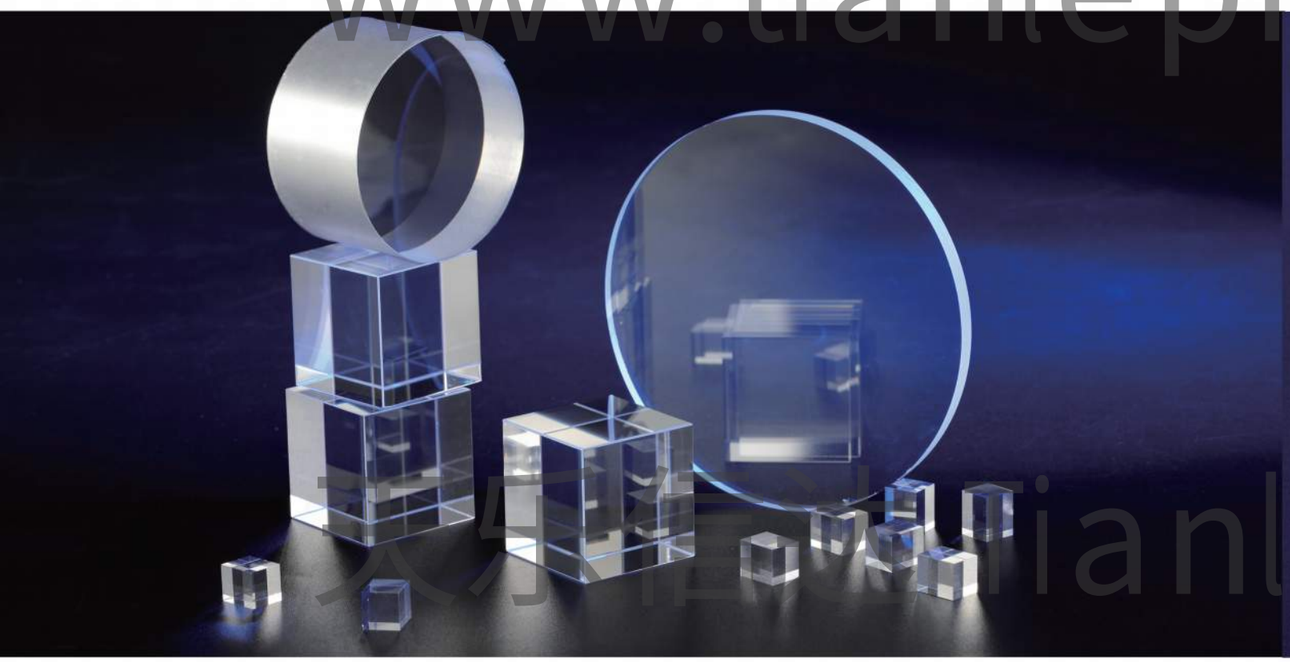
Tianle Photonics dedicates its wholw efforts and intelligence to the producing and manufacturing of Scintillation materials, laser materials and related appliances.

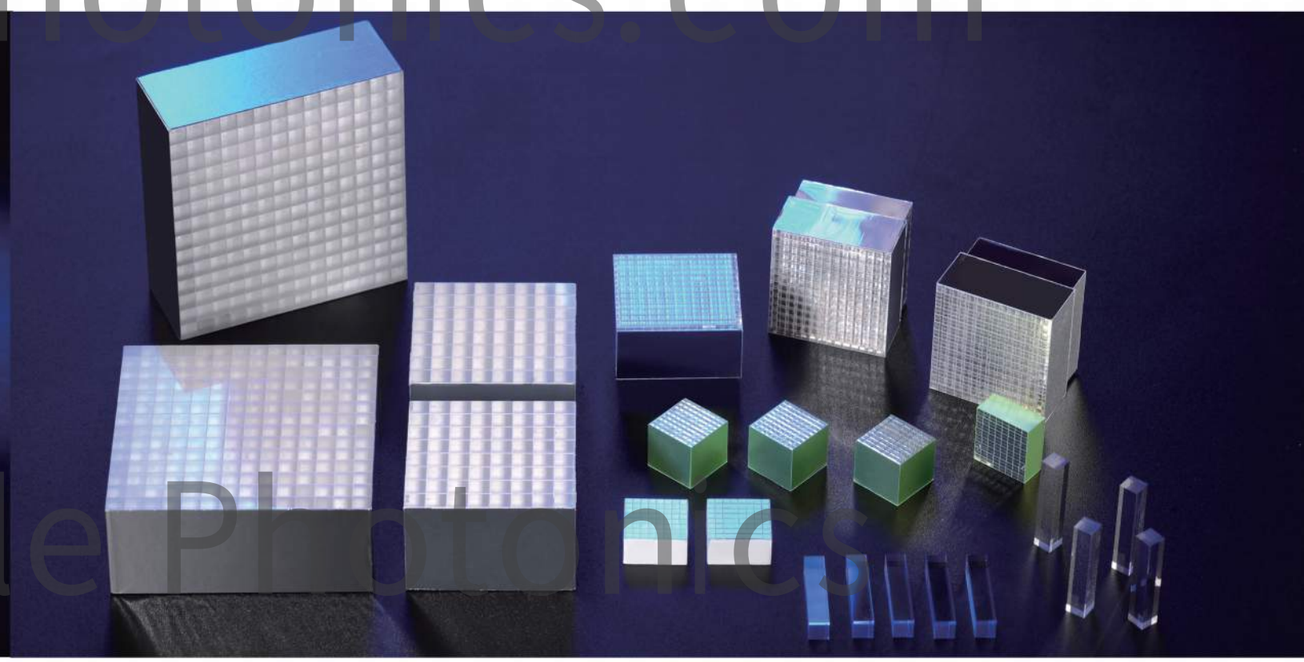
天乐信达致力于闪烁晶体、
激光晶体的生长、加工及相关的长晶设备的研发。

天乐信达
TIANLE PHOTONICS

L(Y)SO Crystal

硅酸(钇)镥闪烁晶体





四川天乐信达光电有限公司
SICHUAN TIANLE PHOTONICS CO.,LTD.

地址/Add:四川省成都市崇州经济开发区科技路力兴之家70号　611230
70 Keji Road Lixingzhijia, Economic Development Zone,
Chongzhou,Chengdu City, Sichuan Province, CHINA

电话/Tel：+86 (0)28 8222 8986
传真/Fax：+86 (0)28 8222 6797
网站Website：www.tianlephotonics.com

QUALITY ASSURED FIRM ISO 9001 CQC

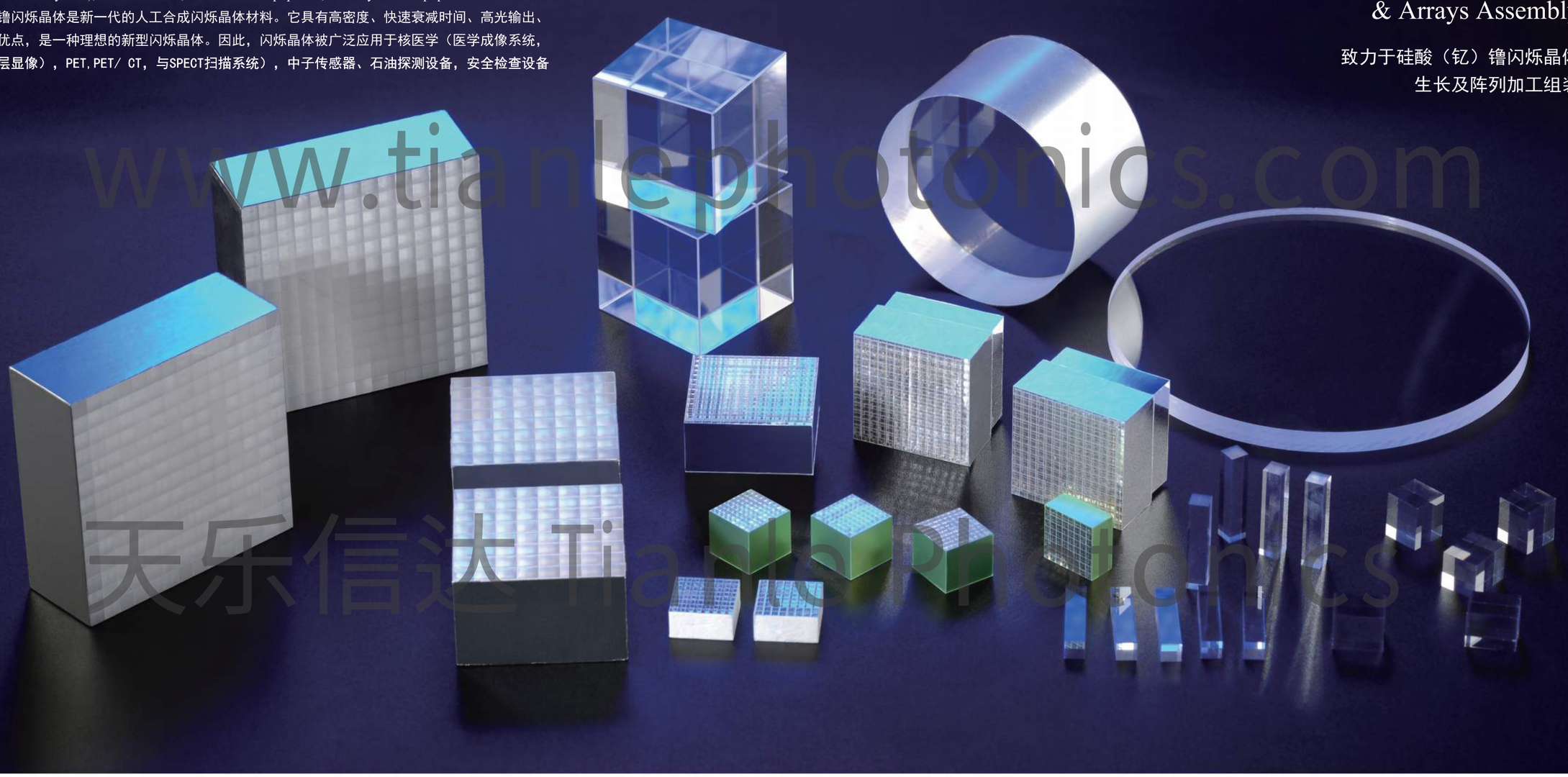
L(Y)SO scintillators
硅酸（钇）镥闪烁晶体

L(Y)SO scintillator crystal ,lutetium(-yttrium)oxyorthosilicate, is a new generation artificially synthesize scintillation crystal material. It has the advantages of high density, fast decay time, high light output, high energy resolution etc. L(Y)SO crystal is an idea general scintillation crystal. L(Y)SO scintillator crystal is widely application in Nuclear medicine (Medical imaging system, such as Positron Emission Tomography, PET, PET/CT, and SPECT scan system), Seutron sensor, Oil detection equipment, Security check equipment.

L(Y)SO硅酸(钇)镥闪烁晶体是新一代的人工合成闪烁晶体材料。它具有高密度、快速衰减时间、高光输出、高能量分辨率等优点，是一种理想的新型闪烁晶体。因此，闪烁晶体被广泛应用于核医学（医学成像系统，如正电子发射断层显像），PET,PET/ CT，与SPECT扫描系统），中子传感器、石油探测设备，安全检查设备等领域。

L(Y)SO Crystal Growth & Arrays Assembly

致力于硅酸（钇）镥闪烁晶体
生长及阵列加工组装



L(Y)SO Scintilators
Manufacturer

COMPANY 企业介绍
INFORMATION

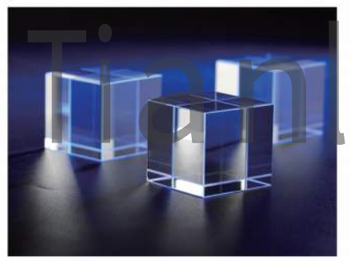
Professional

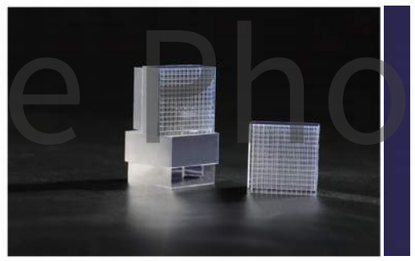
Sichuan Tianle Photonics Co., Ltd is a high technology company, which by a team from rare earth industry and artificially synthesized crystal/ceramic industry experts. Tianle Photonics dedicates its whole effort and intelligence to the producing and manufacturing of scintillation materials, laser materials and related appliances.

Tianle Photonics has a full production capacity of producing and manufacturing all the scintillation crystals/ materials and providing our customers with plates, columns, and arrays. We have our own lab to test the scintillation properties and to make sure our products all at the same king quality. We offer professional solutions for scintillation crystal growth, surface treatment and array assembly.

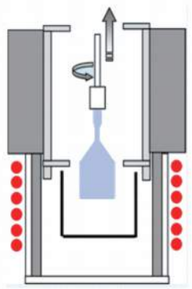
四川天乐信达光电有限公司（以下简称天乐信达）是由一批从稀土行业和人工晶体行业的专家所创立的高新材料科技公司。天乐信达致力于闪烁晶体、激光晶体的生长、加工及相关的长晶设备的研发。

天乐信达有完整的闪烁晶体和激光晶体的晶体生长、晶体加工及封装的能力，给客户提供晶锭、晶段、晶体条、及晶体阵列。我们有自己的实验室来测试闪烁性能并保障晶体的一致性，确保我们的产品质量满足客户需求。我们为客户提供专业的闪烁晶体的解决方案，包括晶体生长、表面处理和阵列组装。





A Dun & Bradstreet D-U-N-S® Registered™ Business
Click here to confirm the online D-U-N-S® Registered™ Profile for Sichuan Tianle Photonics Co., Ltd.
点击查看四川天乐信达光电有限公司的 邓白氏注册档案



Crystal Growth

Czochralski Growth

成熟的提拉法长晶

Properties
Density (g/cm3)..... 7.2
Melting Point(℃).....2050
Hardness (Mohs).....5.8
Refractive Index.....1.12
Effective Atomic Number ...66
Radiation Length (cm) 1.10
Decay Constant (ns) .....<42
Peak Emission (nm) 428
Peak excitation (nm) 375
Radiation Hardness (rad) .....>10
Cleavage .....None
Hygroscopicity .....No
Light Output .....76% of Nal(TI)
Energy Resolution 8-10%
Light Yield .....32,000 Photon/Mev

CRYSTAL GROWTH
晶体生长

Biggest L(Y)SO Producer

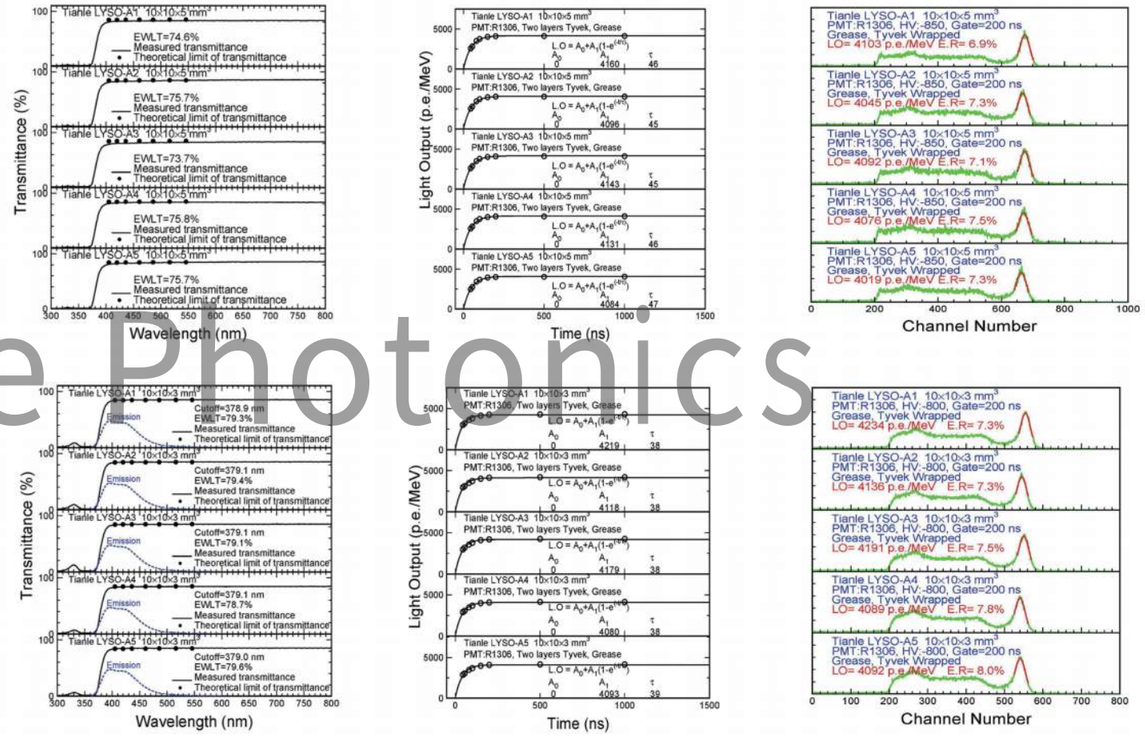
Tianle Photonics is currently the best professional and largest L(Y)SO producer in China, with the 25 unites of crystal growth furnaces and the monthly production volume of 400 KG LYSO. This moment, Tianle Photonics have successfully development big size crystal. The diameter of Crystal can be reach to105mm, which is 15%-31% bigger than normal LYSO crystal size Bigger diameter crystal makes a significant contribution to increase cost efficiency.

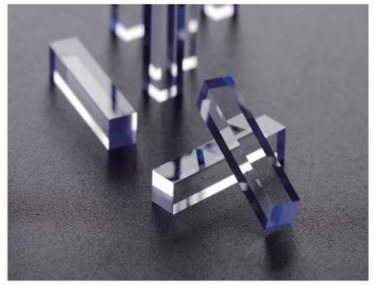
天乐信达目前是国内最专业最具规模的L(Y)SO晶体生长商， 截止2018年初，天乐信达有L(Y)SO生长单晶炉25台，L(Y)SO晶体月产量为260KG。天乐信达在晶体生长的研发取得了瞩目的成绩，我司成功研发出直径为105mm的大直径L(Y)SO晶体，比常规直径为70-80mm的晶体大了15-31%，随着大直径L(Y)SO的研发成功，天乐信达对L(Y)SO晶体的成本降低，大规模量产及成本效率的提高做出了极其重要的贡献。

CRYSTAL 晶体性能 PROPERTIES

Excellent Scintillation Properties

★ High Light Yield
高光产额
★ High Energy Resolution
优异的能量分辨率
★ Fast Decay Time
快速衰减时间
★ High Uniformity
出色的一致性





Multi wire Sawing 多线切割

Inner Circle Cutting 内圆切割

Crystal Manufacture Capability
晶体加工能力

High-Precision Manufacture Processing

Step-1: Testing the L(Y)SO crystal properties before stating to precede the crystal array assembly.

Step-2: For cutting, we choose inner circle cutting machine to slice the crystal; and cut the slice into crystal element by high-precision multi wire cutting technology.

Step-3: Grinding and chemical mechanically polishing, the quantity of surfaces and the polishing time can be decided by customer.

Step-4: Checking every single crystal element, to sure there is no corner and edge breakage.

Grinding & Polishing 研磨抛光

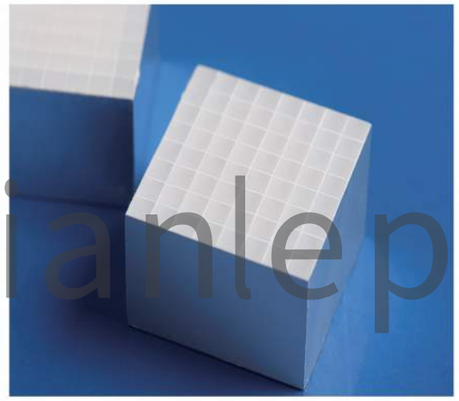
第1步：晶体开始加工前，对晶体磅进行多部位取料进行晶体闪烁性能测试。合格的晶体流转到晶体加工环节。

第2步:我司拥有内圆切割机对晶棒进行开段；延后使用高精度的多线切割机进行晶体条切割。精确控制晶体的平面度及角度偏差。

第3步：研磨及抛光，我司根据客户的要求进行单面，或多面的研磨抛光；抛光程度及光洁度参照可由客户确定。

第4步：对所有研抛后的晶体条进行多道性能检测，及三维影像测量仪测量晶体外观情况，挑出性能不合格及晶体外观划伤及崩边缺角的晶体。合格的晶体流转至晶体封装环节，

Crystal Pixellated Arrays for
Clinical Whole-body PET,PET/CT,PET/MRI
临床PET,PET/CT,PET/MRI 晶体阵列

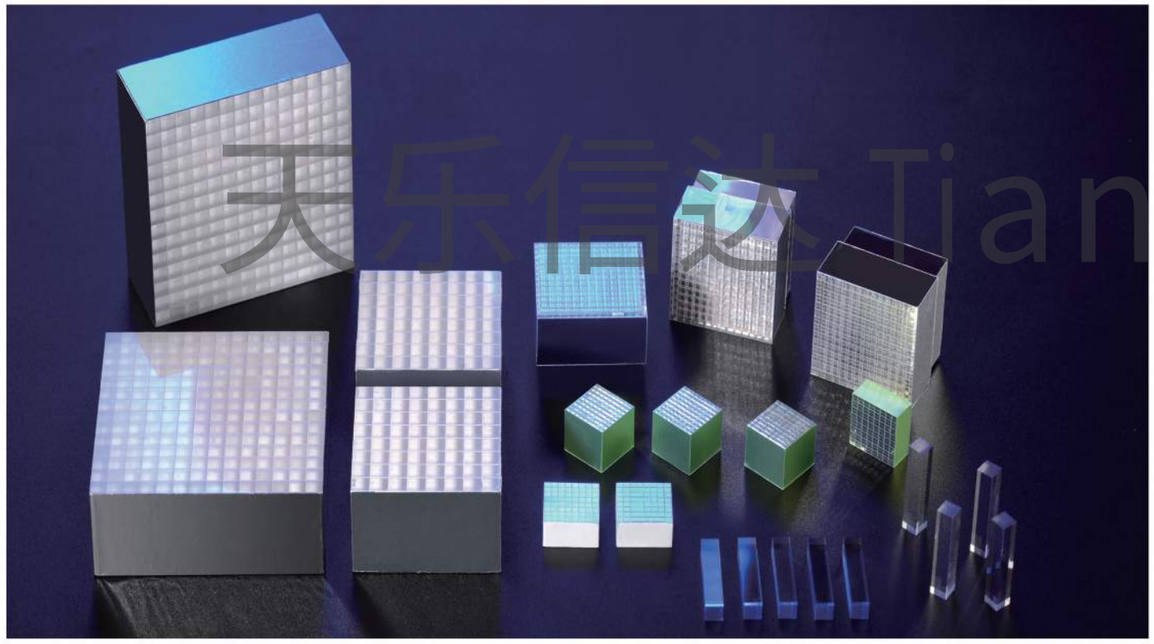


We can produce and manufacture the arrays based on customers' different design options in terms of pixel size, the number of pixels, pixels separator materials(reflective and/or radiation barrier) and crystal surface finishes. Our 2D arrays are typically used with pixilated photodiodes, position sensitive photomultiplier tubes(PSPMT)and silicon photomultipliers(SiPM).

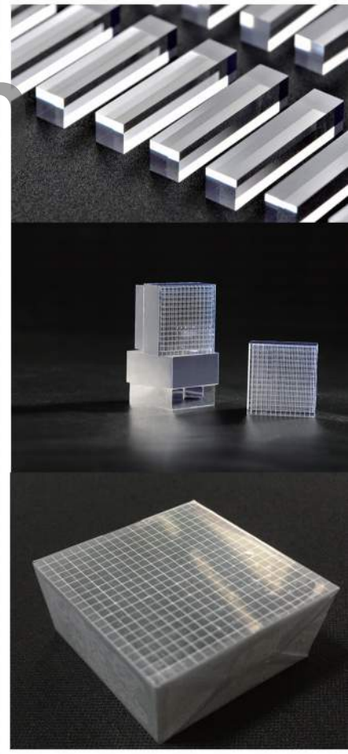
We Offer a variety of design options and reflector materials to optimize array performance for the special application. Tianle photonics' manufacturing process ensure high light output as well as excellent pixel to pixel uniformity with minimal crosstalk.

天乐信达根据客户的晶体阵列设计图纸生产封装晶体阵列，我们可以生产不同尺寸晶体条，用不同的反射介质组装不同维数的晶体阵列。我们生产的2D晶体阵列主要和光电倍增管，位置灵敏型光电倍增管，硅光电倍增管耦合使用。

我们提供多种加工工艺设计方案及反射介质技术来实现晶体阵列在探测器模块应用中的最大化的性能表现。天乐信达所掌握的成熟生产加工工艺确保了晶体光输出和一致性的优异性，从而最大化的降低阵列内部的晶体串光现象。



L(Y)SO crystal Arrays Assembly
L(Y)SO 晶体阵列封装



We offer professional solutions on L(Y)SO crystal growth, surface treatment (Cutting, grinding, mechanically polishing) and array assembly.
Surface Treatment Procedure:
Step-1: Testing the L(Y)SO crystal properties before stating to precede the crystal array assembly.
Step-2: For cutting, we choose inner circle cutting machine to slice the crystal; and cut the slice into crystal element by high-precision multi wire cutting technology.
Step-3: Grinding and chemical mechanically polishing, the quantity of surfaces and the polishing time can be decided by customer.
Step-4: Checking every single crystal element, to sure there is no corner and edge breakage.
Step-5: Crystal array assembly with perfect high reflector technology.

Separator/Reflector:
ESR Film, White Plastic, BaSO4, TiO2 based reflector, and so on.
The reflector material we use between the pixels provides outstanding reflection as well as excellent protection against optical crosstalk.

天乐信达提供专业的L(Y)SO晶体生长、晶体加工、晶体封装等一系列的解决方案。
晶体加工及封装：
第1步：测试晶体性能，晶体闪烁性能合格的晶体进入晶体加工（切割、研磨、抛光环节。
第2步：内圆切割机对晶棒进行开段；延后使用高精度的多线切割机进行晶体条切割。精确控制晶体的平面度及角度偏差。
第3步：研磨及抛光，根据客户的设计要求进行单面，或多面的研磨抛光；抛光程度及光洁度参照客户的技术指标。
第4步：检验抛光后的晶体条，并根据性能及外观条件进行分类。
第5步：根据客户要求采用漫反射反射介质或镜面反射介质进行封装。

反射介质：
ESR反射膜、白色反射颗粒、基于BaSO4、TiO2 的反射介质。
我们在晶体条之间的反射介质技术，提供了出色的反射效率，及大的避免了晶体之间的串光现象。

COMPARATIVE STUDY OF LYSO PRECLINICAL PET CRYSTALS

MEASURED BY: PÉTER MAJOR PHD

DATE: JANUARY 30, 2017

Reported crystals:

#1. *Reference #443, 70 micron, 183.7 g*
#2. *Sample Tianle Photonics BaSO4, 182.66 +/- 0.02 g*

Dimensions of crystal:

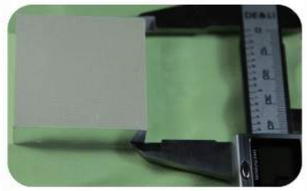
- Matrix: 39 x 39
- Pitch (mm): 1.17
- Reflector (mm): 0.05

Methods:

- Regularity of the crystal needles in the Anger image (qualitative analysis)
- Relative Peak Height (RPH), change of light yield (quantitative analysis)

Equipment:

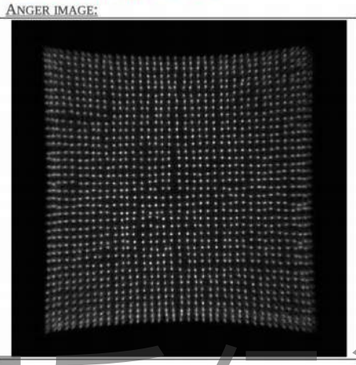
- Intensifier: Hamamatsu PSPMT 11950, HV: 690V
- Radioactive source: ^{22}Na



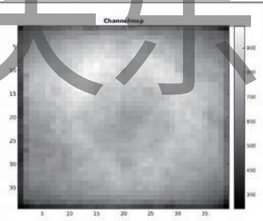
Array Picture

Crystal #1: *Reference #443*

ANGER IMAGE:



PHOTOPEAK CHANNEL NUMBER MAP:



RPH MAP:

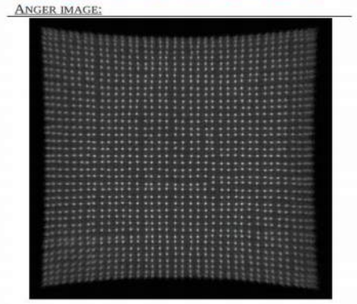
100% by definition

NOTE:
Distinguishable peaks also in the boundary region and regular net. Reference crystal represents the barely acceptable image quality to help the decisions about questionnable crystals, not the best ever.

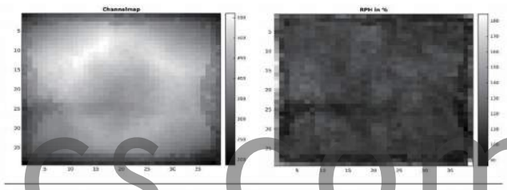
	Average (%)	Standard deviation (%)
RPH RESULT	100 (by definition)	-

Crystal #2: *Tianle Photonics 50 micron BaSO4 sample*

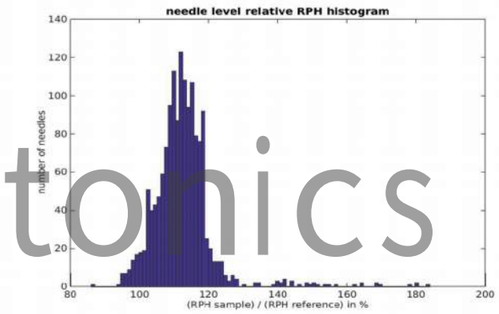
ANGER IMAGE:



PHOTOPEAK CHANNEL NUMBER MAP: RPH MAP:



NOTE:
Distinguishable peaks also in the boundary region and regular net, smooth RPH map. The histogram of the needle-by-needle relative RPH ratio shows some shiny needles compared to the reference, due to the lower RPH of the first (left) column of the reference crystal, caused by too much optical grease. We did not consider these values in the mean relative RPH and std calculation.



	Average (%)	Standard deviation (%)
RELATIVE RPH	112.4	±8.8

Summary:

The image quality, the separable needles, the uniformity of the RPH values and the relative light yield is better than the required minimum standard for the detector calibrations.

21 道产品过程检验，
交付给客户的既是品质也是口碑！

QUALITY CONTROL SYSTEM 质量控制体系

We have our products approved by our Japanese, American and China domestic clients. Feedback from them proved that our crystal with excellent scintillation properties and perfect consistently unifomity. All our L(Y)SO crystal will be checked and inspected 21 times under our quality inspection team,before final delivery to our customers.

天乐信达的晶体受到国内外客户的一致认可。从客户反馈的信息来看，我们的晶体闪烁性能优异并保持着出色的一致性。天乐信达的晶体在交付给客户之前会进行21次生产过程的检验，确保交付的晶体产品满足客户的需求。

质量管理体系认证证书

证书号：ABZB18Q30136R0M
统一社会信用代码：91510184096144032K

兹证明

四川天乐信达光电有限公司

质量管理体系符合
GB/T19001-2016/ISO9001:2015标准，适用于

硅酸钇镥（LYSO）晶体的研发、生产、销售和服务；稀土氧化物的销售

注册地址：四川省成都崇州经济开发区创新大道力兴之家70号
经营地址：四川省成都崇州经济开发区创新大道力兴之家70号

初次发证日期：2016年02月18日
本次发证日期：2018年02月08日
证书有效期至：2019年02月17日

颁证机构盖章：

CERTIFICATE OF QUALITY MANAGEMENT SYSTEM CERTIFICATION

Certificate No.:ABZB18Q30136R0M
Unified social credit code:91510184096144032K

This is to Certify that the Quality Management System of

SICHUAN TIANLE PHOTONICS CO., LTD.

is in conformity with
GB/T19001-2016/ISO9001:2015 Standard, applies to

R&D, PRODUCTION, SALES AND SERVICE OF LUTETIUM-YTTRIUM OXYORTHOSILICATE (LYSO); SALES OF RARE EARTH OXIDES

REGISTERED ADDRESS:70 KEJI ROAD, LIXINGZHUIA, ECONOMIC DEVELOPMENT ZONE, CHONGZHOU, CHENGDU CITY, SICHUAN PROVINCE
OPERATION ADDRESS:70 KEJI ROAD, LIXINGZHUIA, ECONOMIC DEVELOPMENT ZONE, CHONGZHOU, CHENGDU CITY, SICHUAN PROVINCE

Date of Initial Issuance: Feb. 18, 2016
Date of Issuance: Feb. 08, 2018
Date of Expiration: Feb. 17, 2019

BCC Inc.
President:

报告编号:NB2017071143

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测试报告

检测机构	:	宁波中普检测技术服务有限公司 浙江省宁波市鄞州中心区华源路 59 号 6&7 楼 邮编：315192
申请方	:	四川天乐信达光电有限公司 四川省成都市崇州经济开发区创新大道力兴之家 70 号
样品名称	:	LYSO 硅酸钇镥闪烁晶体
型号	:	/
样品描述	:	/
材质	:	/
样品接收时间	:	2017 年 07 月 11 日
完成日期	:	2017 年 07 月 13 日
检测地点	:	宁波中普检测技术服务有限公司
检测项目	:	欧盟议会和欧盟理事会2011/65/EU指令和修订指令(EU)2015/863 关于在电气电子设备中限制使用某些有害物质指令—(RoHS)

王升艳 编 制：王升艳　　许积斐 报告审核：许积斐　　骆心益 批 准：骆心益

宁波中普检测技术服务有限公司 检测报告专用章

宁波，2017 年 07 月 17 日

检测结果仅对来样负责，未经客户授权，部分与修改的检测报告禁止对外发布禁止使用宁波中普检测技术服务有限公司检测报告专用章及骑缝章

报告编号:NB2017071143

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检测项目	:	欧盟议会和欧盟理事会2011/65/EU指令和修订指令(EU)2015/863 关于在电气电子设备中限制使用某些有害物质指令—(RoHS)
检测方法	:	国际电工委员会 IEC 62321-4:2013，用 ICP-OES 测定铅和镉的含量 国际电工委员会 IEC 62321-4:2013，用 ICP-OES 测定汞的含量 国际电工委员会 IEC 62321:2008，用紫外-可见分光光度计比色法测定六价铬的含量 国际电工委员会 IEC 62321-6:2015，用GC-MS测定PBBs和PBDEs的含量 US EPA 3540C:1996 和US EPA 8270D:2014，用GC-MS测定DEHP、DBP、BBP和DIBP的含量
样品来源	:	欧盟议会和欧盟理事会指令2011/65/EU和修订指令(EU)2015/863

样品名LYSO 硅酸钇镥闪烁晶体					
检测	单位	检出限	结果	限制	结论
铅 (Pb)	mg/kg	10.0	31.3	1000	合格
镉 (Cd)	mg/kg	10.0	ND	100	合格
汞 (Hg)	mg/kg	10.0	ND	1000	合格
六价铬 (Cr VI)	mg/kg	10.0	ND	1000	合格
多溴联苯 (PBBs)					
1、一溴联苯	mg/kg	10.0	ND	--	--
2、二溴联苯	mg/kg	10.0	ND	--	--
3、三溴联苯	mg/kg	10.0	ND	--	--
4、四溴联苯	mg/kg	10.0	ND	--	--
5、五溴联苯	mg/kg	10.0	ND	--	--
6、六溴联苯	mg/kg	10.0	ND	--	--
7、七溴联苯	mg/kg	10.0	ND	--	--
8、八溴联苯	mg/kg	10.0	ND	--	--
9、九溴联苯	mg/kg	10.0	ND	--	--
10、十溴联苯	mg/kg	10.0	ND	--	--
PBBs 总和	mg/kg	--	ND	1000	合格
多溴二苯醚(PBDEs)					
1、一溴二苯醚	mg/kg	10.0	ND	--	--
2、二溴二苯醚	mg/kg	10.0	ND	--	--
3、三溴二苯醚	mg/kg	10.0	ND	--	--
4、四溴二苯醚	mg/kg	10.0	ND	--	--
5、五溴二苯醚	mg/kg	10.0	ND	--	--
6、六溴二苯醚	mg/kg	10.0	ND	--	--
7、七溴二苯醚	mg/kg	10.0	ND	--	--
8、八溴二苯醚	mg/kg	10.0	ND	--	--
9、九溴二苯醚	mg/kg	10.0	ND	--	--
10、十溴二苯醚	mg/kg	10.0	ND	--	--
PBDEs 总和	mg/kg	--	ND	1000	合格
邻苯二甲酸二(2-乙基)己酯 (DEHP)	%	0.005	ND	0.1	合格
邻苯二甲酸二丁酯 (DBP)	%	0.005	ND	0.1	合格
邻苯二甲酸丁苯午酯 (BBP)	%	0.005	ND	0.1	合格
邻苯二甲酸二异丁酯 (DIBP)	%	0.005	ND	0.1	合格