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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 22453-2025

Replacing GB/T 22453-2008

**Measuring methods for the performance of non-linear optical
crystal devices for lasers**

激光用非线性光学晶体元件性能测量方法

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part

1. Structure and drafting rules for standardization documents" Drafting. This document replaces GB/T 22453-2008 "Quality Test Methods for Borate Nonlinear Optical Single Crystal Components" and GB/T 22453- Compared with.2008, in addition to structural adjustments and editorial changes, the main technical changes are as follows:

- Added "Terms and Definitions" (see Chapter 3);
- Deleted "Main test items" (see Chapter 3 of the.2008 edition);
- Changed the test environment requirements and relative humidity (see Chapter 4, Chapter 4 of the.2008 edition);
- Added "environmental requirements", "test equipment and measurement requirements" and "laser safety requirements" (see 4.1, 4.2, 4.3);
- Changed the test method classification from "physical properties" and "processing properties" to "laser properties", and changed "optical inhomogeneity" to "Optical uniformity" (see Chapter 5, Chapter 5 of the.2008 edition);
- Added SHG operating wavelength, specific wavelength SHG critical phase matching angle, light transmission wavelength range, and film layer's high humidity resistance, Test method for the film's resistance to temperature shock (see Chapter 5);
- Changed the test method for absorption at specific wavelengths (see Chapter 5, Chapter 5 of the.2008 edition);
- Added the test methods for specific wavelength absorbance. "Photothermal lens method" and "Spectrophotometer method" (see Chapter 5);
- Deleted the indicators such as dimensional tolerance, angular deviation, non-parallelism, non-flatness, non-perpendicularity, surface roughness, etc. (see the.2008 edition Chapter 5 of);
- Added test report (see Chapter 6). Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents. This document was proposed by the China Machinery Industry Federation. This document is under the jurisdiction of the National Technical Committee on Optical Radiation Safety and Laser Equipment Standardization (SAC/TC284). This document was drafted by: Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, Mindu Innovation Laboratory, Fujian Fujing Technology Co., Ltd., The Institute of Aerospace Information Innovation of the Chinese Academy of Sciences, the 26th Institute of China Electronics Technology Group Corporation, and the Jiangxi Provincial Inspection, Testing and Certification Institute Industry Product Inspection and Testing Institute, Beijing Leishengqiang Technology Co., Ltd., Chengdu Dongjun Laser Co., Ltd., China Electronics Technology Group The 11th Research Institute of the Company, the 209th Research Institute of China Ordnance Industry, Han's Laser Technology Industry Group Co., Ltd., China Metrology University. The main drafters of this document are. Zheng Yi, Wang Shuaihua, Huang Xin, Zheng Fakun, Wu Shaofan, Ma Yunfeng, Zhang Xing, Chen Wei, Ding Yuchong, He Tongbin, Zhang Ge, Zhu Jianhui, Zhou Shibin, Sun Yutong, Guo Li, Jia Kai, Qin Laishun, Li Bingxuan, Chen Min, Luo Xingmu, Chai Xiandan. The previous versions of this document and the documents it

replaces are as follows:

---First published in 2008 as GB/T 22453-2008;

---This is the first revision. Performance measurement method of nonlinear optical crystal element for laser

1 Scope

China's national methods for measuring the performance of non-linear optical crystal devices used with lasers. It specifies the test conditions, describes the corresponding test methods and specifies the content of the test report, and it applies to beta-barium borate, lithium triborate, potassium dihydrogen phosphate and the other crystals used for frequency conversion. This is the companion to GB/T 22452: that standard says what the device must be, this one says how each of those properties is measured. The difficulty is that almost every property of a non-linear crystal is a property of the crystal and the beam together, so a number quoted without the measurement conditions is meaningless. The conversion efficiency depends on the wavelength, the pulse duration, the repetition rate, the beam diameter and the power density, and it rises and then falls as the power density increases, so an efficiency quoted at one condition cannot be compared with one measured at another. The laser damage threshold depends on the pulse duration through a well-known scaling and on the number of shots, since damage is partly cumulative, so a threshold has to state both. The acceptance angle, the walk-off and the temperature bandwidth are properties of the phase matching and depend on the wavelength being converted. The transmittance and absorption have to be separated from the surface and coating losses. So the standard's substance is the specification of the conditions: the source and its characterisation, the beam preparation and measurement, the detectors and their calibration, the sample mounting and temperature control, and the procedure for each property, with the report content that makes a result reproducible. Issued on 25 April 2025 and in force since 1 August 2025, it replaces GB/T 22453-2008.

This document specifies the test conditions for nonlinear optical crystal elements, describes the corresponding test methods, and specifies the content of the test report. Require. This document applies to low-temperature phase barium borate (beta-BaB₂O₄, referred to as BBO), lithium triborate (LiB₃O₅, referred to as LBO), potassium dihydrogen phosphate (KH₂PO₄, referred to as KDP), potassium titanyl phosphate (KTiOPO₄, referred to as KTP), lithium niobate (LiNbO₃, referred to as LN), silver gallium sulfide The measurement activities of AgGaS₂ (AGS) and potassium iodate (KIO₃) are also used for reference in the measurement activities of other nonlinear optical crystal elements.

2 Normative references

The contents of the following documents constitute essential clauses of this document

through normative references in this document. For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to This document.

GB/T 7247.1 Safety of laser products Part

3 Terms and definitions

The terms and definitions defined in GB/T 15313, GB/T 11293, GB/T 39131 and GB/T 22452-2025 apply to this document.

4 Test conditions

4.1 Environmental conditions Unless otherwise specified, the test environment conditions shall meet the following requirements.

- a) Air pressure. 86kPa~106kPa;
- b) Cleanliness level. ISO 7;
- c) Ambient temperature. $23^{\circ}\text{C}\pm 2^{\circ}\text{C}$;
- d) Relative humidity. $\leq 60\%$;