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Test methods for active ion concentration in laser material

激光材料中激活离子浓度测试方法

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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.

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.

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Introduction

Solid-state lasers and fiber lasers play an increasingly important role in industrial processing, communications, medical treatment, lidar, and scientific research.

As the core working material in solid lasers and fiber lasers, laser materials convert pump light into The laser is replaced by a laser of a specific wavelength. Commonly used laser materials include laser glass, laser crystal, laser ceramic and laser fiber. The concentration of active ions is One of the key performance indicators of laser materials, it plays an important role in the performance evaluation of laser materials and the development of lasers.

The test of the concentration of activated ions in laser materials lacks standardized test methods and cannot meet the development requirements of laser materials, lasers and laser technology.

In order to meet the development needs, it is urgent to formulate unified testing standards.

This document was developed to define in one document common test methods for the concentration of active ions in different types of laser materials.

There are inductively coupled plasma optical emission spectrometry (ICP-OES), inductively

coupled plasma mass spectrometry (ICP-MS), X-ray fluorescence spectrometry (XRF), electron probe microanalysis (EPMA) and glow discharge mass spectrometry (GD-MS), etc.

The formulation of this document is conducive to the research and development, production and application of laser materials, and is conducive to the standardized application of laser material product standards.

Test method for active ion concentration in laser materials

1 Scope

This document describes the test method for the concentration of active ions in laser materials and specifies the test conditions, sample preparation, test procedures and data.

The processing process and test report format are given.

This document is applicable to the test of the concentration of activated ions in the range of $(0.001\sim150)\times10^{20}\text{ion/cm}^3$ in laser materials.

The tests of other ion concentrations such as sensitization shall be carried out for reference.

2 Normative references

GB/T 4930

GB/T 6682

GB/T 14666

GB/T 15074

GB/T 15313

GB/T 16597

GB/T 17366

GB/T 21636

GB/T 23942

GB/T 25915.1

GB/T 27418

GB/T 39486

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3 Terms and definitions

The terms and definitions defined in GB/T 14666, GB/T 15313 and GB/T 21636 and the following apply to this document.

3.1 Laser materiallaser material

A solid gain medium that converts pump light energy into laser light by activating ions.

Note 1.Laser materials usually consist of two parts. active ions and solid matrix materials.

Note 2.Solid matrix materials usually include glass, crystal, ceramics and optical fiber.

3.2 Active ion

Metal ions whose energy level structure can achieve population inversion under the action of pump light.

Note. The main activating ions are transition metal ions such as titanium (Ti), chromium (Cr), manganese (Mn), cobalt (Co), nickel (Ni), etc.; rare earth metal ions such as cerium (Ce), praseodymium (Pr), Neodymium (Nd), samarium (Sm), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), etc.