



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

GB/T 24370-2021

**Nanotechnologies - Characterization of cadmium chalcogenide
colloidal quantum dot - UV-Vis absorption spectroscopy**

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Foreword

This document was drafted in accordance with the rules provided in GB/T 1.1-2020 Directives

for Standardization - Part 1.Rules for the Structure and Drafting of Standardizing Documents.

This document serves as a replacement of GB/T 24370-2009 Characterization of CdSe Quantum Dot Nanocrystals - UV-Vis Absorption Spectroscopy. In comparison with GB/T 24370-2009, apart from structural adjustments and editorial modifications, the main technical changes are as follows.

- The scope of application is expanded. from CdSe quantum dots to cadmium chalcogenide (CdTe, CdSe and CdS) quantum dots, and the diameter range of applicable CdSe quantum dots is clarified (see Chapter 1; Chapter 1 of Version 2009);
- CdTe, CdSe and CdS are added throughout the text;
- The term and definition of "quantum confinement" is added (see 3.2);
- Abbreviations and Symbols is added (see Chapter 4);

- The values of coefficients A, B, C, D and E in the relational expression between the diameter of CdSe quantum dots and the first excitonic absorption peak are corrected (see 5.4; 4.3 of Version 2009);
- The relational expression between the diameter of CdTe and CdS quantum dots and the first excitonic absorption peak is added (see 5.4);
- The content of absorbance correction for samples with wide size distribution is added (see 5.5.2);
- The content of Measurement Uncertainty in Chapter 9 is added;
- The content of Appendix A is modified from "UV-visible absorption spectral line analysis of cadmium selenide quantum dot nanocrystals" into "example of determining the diameter of CdSe quantum dots using UV-Vis absorption spectrum";
- The content of Appendix B is modified from "synthesis of cadmium selenide quantum dot nanocrystals by high-temperature oil phase pyrolysis method" into "example of determining the particle concentration of CdSe quantum dots in dispersion liquid";
- Appendix C - Test Report in Version 2009 is deleted.

This document modifies and adopts ISO/TS 17466.2015 Use of UV-Vis Absorption Spectroscopy in the Characterization of Cadmium Chalcogenide Colloidal Quantum Dots. The

type of the document is adjusted from ISO technical specifications to a national standard of China.

The Chapter Normative References is added to this document.

In comparison with ISO/TS 17466.2015, this document makes the following structural adjustments.

- Terms, Definitions and Abbreviated Terms in Chapter 3 (TRANSLATOR'S NOTE. it should be Chapter 2) of ISO/TS 17466.2015 is modified into Chapter 3 Terms and Definitions, and Chapter 4 Abbreviations and Symbols;
- "General Rule" is added to 3.5 of ISO/TS 17466.2015 (see 5.5.1);
- The first sentence of Chapter 6 in ISO/TS 17466.2015 is moved to "Estimation of Quantum Dot Size" (see 8.1).

The technical differences between this document and ISO/TS 17466.2015, and the causes for

these differences are as follows.

---The definition of "quantum confinement" is modified, and NOTE 2 is added, so as to adapt to the specific conditions of China;

---The last paragraphs of "5.4" and "5.5" are deleted, so as to avoid duplication with Chapter 10 Test Report.

This document makes the following editorial modifications.

---The title of the document is modified into Nanotechnologies - Characterization of Cadmium Chalcogenide Colloidal Quantum Dot - UV-Vis Absorption Spectroscopy;

---The sequence of the sample preparation part in Chapter 6 is adjusted;

---The abbreviation HRTEM is added, and FWHM, which is not quoted in the text, is deleted;

---The coefficient forms following Formula (1), Formula (2) and Formula (3) are modified;

---For the convenience of application, the form of Formula (4) is modified;

---The informative references GB/T 32269-2015 and ISO 13322-1.2004 are incorporated into Bibliography.

Please be noted that certain content of this document may involve patents. The institution issuing this document does not undertake the responsibility of identifying these patents.

This document was proposed by Chinese Academy of Sciences.

This document shall be under the jurisdiction of National Technical Committee 279 on Nanotechnology of Standardization Administration of China (SAC/TC 279).

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Xinyu Rare Earth Functional Materials Co., Ltd.

1 Scope

This Standard provides a method for evaluating the diameter and particle concentration of monodisperse cadmium chalcogenide (CdTe, CdSe and CdS) colloidal quantum dots using UV-

Vis absorption spectroscopy.

2 Normative References

This document does not have normative references.

3 Terms and Definitions

The following terms and definitions are applicable to this Standard.

Light absorption generated when electrons in quantum dots transition from the ground state to

the first excitonic excited state.

4 Abbreviations and Symbols

The following abbreviations are applicable to this document.

5 Principle

Figure 1 is a typical UV-Vis absorption spectrum of CdSe colloidal quantum dots. The peak at

545 nm is the first excitonic absorption peak of quantum dots, which is the absorption peak

with the lowest energy (longest wavelength). It is generated by electrons transitioning from the

valence band to the conduction band after absorbing photons.

6 Sample Preparation

The sample for the determination of the absorption spectrum shall be a uniform and stable quantum dot dispersion liquid.

In order to guarantee the applicability of the Beer-Lambert Law, a dilute dispersion liquid