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

GB/T 24369.2-2018

**Characterization of gold nanorods - Part 2: Measurement
methods for optical properties**

金纳米棒表征 第2部分：光学性质测量方法

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1 Scope

China's national methods for measuring the optical properties of gold nanorods. It is Part 2 of GB/T 24369 and specifies the measurement of the optical properties beyond the absorption spectrum of Part 1 - the extinction, scattering and absorption cross-sections, the photothermal conversion and the related quantities. Part 1 establishes what a gold nanorod suspension looks like in a spectrophotometer, and for identifying the material and its aspect ratio that is enough. It is not enough for using it. An absorption spectrometer measures extinction, which is absorption plus scattering, and it does not separate them - and for the applications that gold nanorods exist for, which one dominates decides everything. A rod used for photothermal therapy or for photoacoustic imaging must absorb, because the useful output is heat; a rod used as a scattering label or in dark-field imaging must scatter, because the useful output is light. The balance between them depends on the particle volume: scattering rises far more steeply with size than absorption does, so two suspensions with identical spectra can behave quite differently in an application if their rods differ in size at the same aspect ratio. So this part specifies how the two are separated and measured - the extinction coefficient on a molar or mass basis, the scattering measured directly, and the absorption obtained by difference or by a photothermal method - together with the photothermal conversion efficiency, which is the figure of merit for a therapeutic or heating application and which requires a calorimetric measurement rather than an optical one. The standard fixes the instruments and their calibration, the concentration

determination on which every cross-section depends, the cell and geometry, and the calculation. Issued on 15 March 2018 and in force since 1 October 2018.

This part of GB/T 24369 specifies the characterization of the main optical properties of gold nanorods. This section applies to surface plasmon resonance peak dielectric sensitivity, relative fluorescence quantum yield, and surface-enhanced Raman scattering enhancement factor. The calculation. The properties of other precious metal nanostructures can also be referred to for implementation.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only dated versions apply to this article. For undated references, the latest version (including all amendments) applies to this document.

GB/T 24369.1-2009 Characterization of gold nanorods. Part 1.

Ultraviolet/visible/near-infrared absorption spectroscopy methods

GB/T 32006-2015 Evaluation method of photothermal effect of gold nanorods

GB/T 32269-2015 Terms and Definitions for nanotechnology nanoobjects Nanoparticles, nanofibers and nanosheets IEC 62607-3-

1 Control of critical properties in the nano-industrial sector. Part 3-1. Quantum yields of luminescent nanomaterials (Nanomanufacturing-Keycontrolcharacteristics-Part 3-

3 Terms and definitions

The following terms and definitions defined in GB/T 32006-2015, GB/T 32269-2015, and IEC 62607-3-1 apply to this document. For ease of use, the following repeatedly lists one of GB/T 32006-2015, GB/T 32269-2015 and IEC 62607-3-

1 Terms and definitions.

3.1 Nanorod nanoord Solid nanofibers. [GB/T 32269-2015, definition 4.5]

3.2 Surface plasmon resonance surfaceplasmonresonance; SPR When light is incident on the surface of a metal nanostructure or a dielectric material, the resulting collective of free electrons and photons on the surface of the metal oscillation. [GB/T 32006-2015, definition 3.3]

3.3 Long-wave surface plasmon resonance longitudinalSPR; LSPR Surface plasmon resonance along the long axis of the rod-shaped particles.

3.4 Dielectric sensitivity The change of the surface plasmon resonance peak caused by the dielectric constant, expressed as the peak shift caused by the change of unit refractive index (nm·RIU-1)[1,2].

7 Measurement Conditions and Step 3

8 Gold nanorod dielectric sensitivity, fluorescence quantum yield, and SERS enhancement factor calculation 4

10 Test Report

5 Appendix A (informative annex) Example of dielectric sensitivity characterization of gold nanorods

6 Appendix B (Informative Appendix) Quantum quantum yield measurement of single photon in gold nanorods

9 Appendix C (Informative Appendix) Calculation Example of Gold Nanorods SERS Enhancement Factor

11 Appendix D (Informative) Uncertainty Analysis of Test Results

14 Appendix E (Informative Appendix) Gold Nanorod Dielectric Sensitivity Test Report Format

16 Appendix F (informative) Gold nanorod fluorescence quantum yield test report format

18 Reference 19

GB/T 24369 "Gold nanorod characterization" is divided into the following three parts.

--- Part 1. UV/Vis/NIR absorption spectroscopy;

--- Part 2. Measurement methods for optical properties;

--- Part 3. Surface charge density measurement methods. This part is part 2 of GB/T 24369. This section was drafted in accordance with the rules given in GB/T 1.1-2009. This section was proposed by the Chinese Academy of Sciences. This section is under the jurisdiction of the National Nanotechnology Standardization Technical Committee (SAC/TC279). This section was drafted by: National Center for Nanoscience. The main drafters of this section. Wu Xiaochun, Ji Yinglu, Hu Zhijian, Chen Jiaqi, Guo Yuting.

Gold nanorods are rod-shaped gold nanoparticles, which have potential in biomedical, energy and information fields because of their excellent optical and electrical properties. Application prospects. Among them, the enhanced optical properties of the gold nanorod local electromagnetic field, such as. local surface plasmon resonance absorption/scattering, two-photon (multiphoton) fluorescence, surface-enhanced Raman scattering, surface-enhanced fluorescence, photothermal and photoacoustic conversion, and plasmon photocatalysis are expected to be Field detection, biological imaging, disease diagnosis and treatment are widely used. This section gives the main optical properties of gold

nanorods Characterization methods and stipulations of surface plasmon dielectric sensitivity, single photon excitation relative fluorescence quantum yield and enhanced surface-enhanced Raman scattering Factor measurement method. Gold nanorod characterization Part 2. Measurement of optical properties

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