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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 47281-2026

Nanotechnology - Chemical composition detection of nano-objects - Graphene plasmon surface-enhanced infrared spectroscopy

纳米技术 纳米物体化学成分检测 石墨烯等离激元表面增强红外光谱法

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part

1.Structure and Drafting Rules of Standardization Documents". Drafting. Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents. This document was proposed by the Chinese Academy of Sciences. This document is under the jurisdiction of the National Technical Committee on Standardization of Nanotechnology (SAC/TC279). This document was drafted by: National Center for Nanoscience and Technology, Shanghai Jiao Tong University, China Customs Science and Technology Research Center, and China Quality Inspection and Quarantine Bureau. Institute of Measurement Science, China Agricultural University. The main drafters of this document are. Dai Qing, Yang Xiaoxia, Hu Hai, Wu Chenchen, Liu Xin, Hu Debo, Wang Yikai, Xi Guangcheng, Qiu Ye, Ma Xi, and Duan Yu.

With the continuous advancement of science and technology, the demand for identifying the chemical composition of nanoscale objects is increasing both domestically and internationally. For example, in integrated circuit manufacturing... During manufacturing, semiconductor materials may be contaminated by nanoscale organic matter, thus affecting the conductivity and stability of circuits; in the field of environmental monitoring, it is necessary to... To accurately identify nanoplastic particles and nanoscale carbon particles that pose potential risks to ecosystems and human health; in medical pathology and In biological research, because the functions of molecules such as proteins and DNA are realized at the nanoscale, the identification of nanomaterials is crucial. Studying the

structure and function of biological tissues is crucial; in the fields of food and drug safety, it is necessary to detect nanoparticles that pose a potential threat to human health. Rice additives, etc. Infrared spectroscopy can characterize the chemical composition of substances through the vibrational information of molecular groups. It is fast and non-destructive, and has been applied in materials science. It has wide applications in the field of analysis. However, due to the large size difference between nanoscale objects and infrared wavelengths, their infrared absorption signals... The infrared spectrum is relatively weak, and traditional infrared spectroscopy methods have certain limitations in detecting the chemical composition of nanomaterials. Plasmons are free charge carriers in materials. The excitation mode generated by the coupling of collective oscillations with electromagnetic waves can compress electromagnetic field energy to the nanoscale, thereby enhancing the infrared response of matter. Graphene possesses atomic-level thickness, high carrier mobility, and electrically tunable properties, and can be excited in the mid-infrared region under periodic nanostructure conditions. Polaritons localize electromagnetic field energy to a nanoscale region on the surface, thereby enhancing the infrared absorption signal of neighboring molecules. Based on the above principle... The graphene plasmon-enhanced infrared spectroscopy technique provides a new technical approach for characterizing the chemical composition of nanomaterials. This document standardizes a graphene plasmonic surface-enhanced infrared spectroscopy method for determining the chemical composition of nanomaterials, which can be widely applied. Highly sensitive and rapid detection of trace biomolecules, harmful gases, organic matter, etc., for applications in biomedicine, industrial production, customs inspection, and food safety. It provides efficient testing methods for fields such as environmental monitoring and agriculture. Detection of chemical composition of nanomaterials using nanotechnology Graphene plasmon surface-enhanced infrared spectroscopy

1 Scope

GB/T 47281-2026 is the Chinese national standard covering identifying what a nanoparticle is made of by using graphene plasmons to amplify its infrared absorption - a technique that reaches quantities of material far below what ordinary infrared spectroscopy can see. First edition, in force since 1 October 2026, under the Chinese Academy of Sciences. It was issued on 31 March 2026 and takes effect on 1 October 2026, as a first edition. This page is published from the official record of the 2026 edition; the clause text of a standard this recent is not yet in circulation, and the figures, limits and tables it contains are those of the document itself, delivered in full with the English translation.

This document describes a method for measuring the chemical composition of nanomaterials using graphene plasmon surface-enhanced infrared spectroscopy. This document is applicable to the qualitative detection of chemical composition of nanomaterials with a thickness between 10 nm and 100 nm.

2 Normative references

This document has no normative references.

3 Terms and Definitions

The following terms and definitions apply to this document.

3.1 nanoscale Size range between 1nm and 100nm. [Source: GB/T 30544.1-2014, 2.1]

3.2 graphene A single layer of carbon atoms with a honeycomb structure is formed by one carbon atom bonded to three neighboring carbon atoms. [Source: GB/T 30544.3-2025, 3.1.13]

3.3 nano-object Objects with one-dimensional, two-dimensional, or three-dimensional external dimensions at the nanoscale.

Note. A general term used for all mutually separated nanoscale objects. [Source: GB/T 30544.1-2014, 2.5]

3.4 Functional groups were identified in nanomaterials with a thickness distribution range of 10 nm to 100 nm to infer their chemical composition.

3.5 nanostructure Interrelated components, one or more of which are located in the nanoscale region. [Source: GB/T 30544.1-2014, 2.6]

3.6 diaphragm In an optical system, a physical object used to control the amount of light flux and to limit the beam of light. [Source: GB/T 6040-2019, 4.2.1, with modifications]