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

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**Surface chemical analysis - Scanning probe microscopy - Procedure
for the determination of elastic moduli for compliant materials using
atomic force microscope and the two-point JKR method**

表面化学分析 扫描探针显微术 用原子力显微镜和两点JKR法测量柔顺材料弹性模
量的程序

(English Translation)

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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.

This document is equivalent to ISO 21222:2020 "Surface chemical analysis - Scanning probe microscopy for atomic force microscopy and two-point JKR".

Procedure for measuring the elastic modulus of compliant materials.

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 and is under the jurisdiction of the National Technical Committee on Standardization of Surface Chemical Analysis (SAC/TC608).

Introduction

A member of the SPM family, it achieves surface imaging by mechanically scanning a surface with a probe. In AFM, the probe tip is located on a cantilever.

The beam's free end interacts with a surface, and this surface interaction force is obtained by monitoring the deflection displacement of the compliant cantilever beam. In addition, AFM can also provide information on the surface topology, mechanical properties, and chemical composition, depending on the operating mode and the nature of the probe tip.

Various applications.

Precise force measurements and sample deformation measurements are required, especially for determining the elastic modulus of compliant material surfaces, such as organic materials and polymers. For quantitative measurement of force, it is necessary to select an appropriate contact mechanics model to calculate the elastic modulus and use an appropriate calculation program.

This document describes the procedure for determining the elastic modulus of compliant materials using AFM. Force-distance curves are obtained on the surface of the compliant material, and...

The elastic modulus was calculated using the Johnson-Kendal-Roberts (JKR) two-point method.

Surface chemical analysis scanning probe microscopy Measurements were taken using atomic force microscopy and the two-point JKR method.

Procedure for measuring the elastic modulus of compliant materials

1 Scope

This document describes the procedure for measuring the elastic modulus of compliant materials using atomic force microscopy (AFM). The measurement is performed on the surface of the compliant material.

The force-distance curves were obtained and analyzed using the two-point method based on the JKR model theory.

This document applies to compliant materials with an elastic modulus ranging from 100 kPa to 1 GPa. Spatial resolution depends on the AFM probe and the surface.

The contact radius between them is typically about 10nm~20nm.

2 Normative references

The contents of the following documents, through normative references within the text, constitute essential provisions of this document. Dated citations are not included.

For references to documents, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies.

This document.

ISO 11775 Surface chemical analysis - Determination of the normal elastic constant of a cantilever beam using scanning probe microscopy Note. GB/T 42543-2023 Surface chemical analysis - Determination of normal elastic constant of cantilever beam by scanning probe microscopy (ISO 11775:2015, IDT) Vocabulary-Part 2:

Terms used in scanning-probe microscopy) Note. GB/T 22461.2-2023 Surface Chemical Analysis Vocabulary Part 2: Scanning Probe Microscopy (ISO 18115-2:2021, MOD)

3 Terms and Definitions

The terms and definitions defined in ISO 18115-2 and the following terms and definitions apply to this document.

Force-distance curve Force-displacement curve Force and distance values in AFM operating mode. In this mode, the probe is set at a fixed (x, y) position, and the probe tip is on the surface.

The force on the probe is measured while it is moving up or down.

Note: The force is usually monitored by the deflection displacement of the cantilever beam.

[Source. ISO 18115-2:2013, 5.56] **3.2 normal spring constant** force constant k_z the quotient of the normal force applied by the AFM probe tip and the deflection of the probe cantilever beam at the tip position.

Note 1: The normal elastic constant is usually referred to as the elastic constant. When it is necessary to distinguish it from the transverse elastic constant, the full term is used.