SLOVENSKI STANDARD
SIST-TS CEN ISO/TS 19590:2024

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Nanotehnologija - Karakterizacija nanoobjektov z uporabo masne spektrometrije z enim delcem v induktivno sklopljeni plazmi (ISO/TS 19590:2024)

Nanotechnologies - Characterization of nano-objects using single particle inductively coupled plasma mass spectrometry (ISO/TS 19590:2024)

Nanotechnologien - Größenverteilung und Konzentration anorganischer Nanopartikel in wässrigen Medien durch Massenspektrometrie an Einzelpartikeln mit induktiv gekoppeltem Plasma (ISO/TS 19590:2024)

Nanotechnologies - Caractérisation des nano-objets par spectrométrie de masse à plasma induit en mode particule unique (ISO/TS 19590:2024)

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CEN ISO/TS 19590

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Supersedes CEN ISO/TS 19590:2019

English Version

Nanotechnologies - Characterization of nano-objects using single particle inductively coupled plasma mass spectrometry (ISO/TS 19590:2024)

Nanotechnologies - Caractérisation des nano-objets par spectrométrie de masse à plasma induit en mode particule unique (ISO/TS 19590:2024)

Nanotechnologien - Charakterisierung von Nanoobjekten mit Hilfe der Massenspektrometrie mit induktiv gekoppeltem Einzelpartikelplasma (ISO/TS 19590:2024)

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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European foreword

This document (CEN ISO/TS 19590:2024) has been prepared by Technical Committee ISO/TC 229 "Nanotechnologies" in collaboration with Technical Committee CEN/TC 352 “Nanotechnologies” the secretariat of which is held by AFNOR.

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Endorsement notice

The text of ISO/TS 19590:2024 has been approved by CEN as CEN ISO/TS 19590:2024 without any modification.

Technical Specification

ISO/TS 19590

Second edition
2024-08

Nanotechnologies — Characterization of nano-objects using single particle inductively coupled plasma mass spectrometry

Nanotechnologies — Caractérisation des nano-objets par spectrométrie de masse à plasma induit en mode particule unique

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 229, *Nanotechnologies*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 352, *Nanotechnologies*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO/TS 19590:2017), which has been technically revised.

The main changes are as follows:

— general restructuring;

— expansion of text on the test method;

— inclusion of considerations regarding method precision and measurement uncertainty;

— updates to normative and bibliographical references.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Following the introduction of single particle inductively coupled plasma mass spectrometry (spICP-MS) by Degueldre in 2003,[1] the technique has increasingly been used for nano-object characterization due to its high sensitivity, elemental specificity, the fact that often minimal sample preparation is needed and the development of much improved instrumentation, along with user-friendly data analysis software.

In spICP-MS, a very diluted suspension containing nano-objects is introduced continuously into an ICP-MS system with the intent that the ion cloud from one particle at a time arrives at the detector, set to acquire data with a high time resolution (i.e. dwell time). Following the nebulization, a fraction of the nano-objects enter the plasma where they are atomized, and the individual atoms ionized. Every atomized particle results in a cloud of ions which is then sampled by the mass spectrometer. The mass spectrometer can be tuned to measure any specific element. Typically, only one mass-to-charge value per single particle will be monitored with a quadrupole-based MS instrumentation. However, the technique can also be used with time-of-flight (TOF) mass spectrometers, allowing simultaneous multi-element and multi-isotope detection.

The number of events detected in each run (time scan) is directly proportional to the number of nano-objects in the suspension introduced but necessitates calibration of the sample transport efficiency to calculate the particle number concentration. Several available approaches to measure the transport efficiency are described in detail in this document. The intensity of the measured signal is directly proportional to the mass of the measured element in the nano-object, which can be derived following appropriate calibration of the instrument's response factor, also described in this document. For particles of known geometry, composition and density, the mass can be related to particle size. Most of the currently available, commercial data analysis software assumes spherical geometry; particle diameter is proportional to the cubic root of the mass of element(s) in a spherical nano-object. In addition to nano-object characterization with spICP-MS, mass concentrations of dissolved element present in the same sample can also be determined from the same data, if a good separation between the dissolved and particulate fraction is achieved. This represents one of the key advantages of the technique.

spICP-MS was once predominantly the domain of specialist laboratories, but with recent developments in commercially available hardware and software, the technique is now more commonly used and increasingly popular for high-throughput analysis as well as high accuracy reference measurements.

Further information on spICP-MS can be found in ISO/TS 24672, and References [1], [2], [3], [4] and [5].