

Project A51

Analysis of the amount of surface functional groups on silica nanoparticles using X-ray photoelectron (XPS) spectroscopy and Secondary Ion Mass Spectrometry (SIMS).

Objectives

- Validate XPS and SIMS-based methods for quantifying surface functional groups on nanoparticles.
- Support the development of standardised protocols for surface chemical analysis.
- Contribute to international standardisation efforts under ISO/TC 201, ISO/ TC 229 and BIPM CCQM SAWG.

Background

Functional groups on nanoparticle surfaces govern interactions with biological systems, catalytic activity, and colloidal stability. While standards exist for particle size and morphology, and despite its importance, there is currently no normative international standard for measuring surface chemistry, particularly the measurands of coating thickness and functional group density.

The European metrology project SMURFnano is helping to address this gap by developing and testing XPS and SIMS-based protocols for functional group quantification. These methods will be evaluated through this international interlaboratory comparison (ILC), enabling

The international interlaboratory comparison (ILC) of this call will be used to assess the reproducibility, uncertainty, and robustness of the developed protocols

This work builds on previous EMPIR and VAMAS activities and aligns with emerging needs in regulatory science, nanomedicine, and materials characterisation.

Standardization Needs

The project will help establish validated protocols for quantifying surface functional groups using XPS and SIMS, and provide input to ISO TC229 nanotechnologies for preliminary work item (PWI) 19257 - Characterization and quantification of functional groups and coatings on nano-objects-

Results will also be presented to ISO/TC 201 for the development of a new international standard(s) or revision of existing guidance.

The ILC will run in parallel to a) BIPM CCQM SAWG pilot studies on nanoparticle surface analysis and b) Project 19 of TWA34 using the same samples with analysis using quantitative NMR (qNMR).

Work Programme

- Obtain nanoparticle samples with known surface functionalities (e.g., amine on silica nanoparticles).
- Development and refinement of XPS and SIMS protocols for quantification.
- Distribution of samples, protocols and additional reference samples to participating labs along with a reporting spreadsheet.
- Performance of ILC by participants.
- Statistical analysis of reproducibility and uncertainty.
- Dissemination of results through peer-reviewed publications and conference presentations.

Deliverables and Dissemination

The interlaboratory study will be delivered. If successful, this will lead to a peer-reviewed publication. Presentations at national and international conferences based on the ILC results are also expected.

Funding

Participants fund their own involvement in the project. Anticipated work is \approx 3 days.

Status

The project will launch in Q4 2025. Experts are invited to participate.

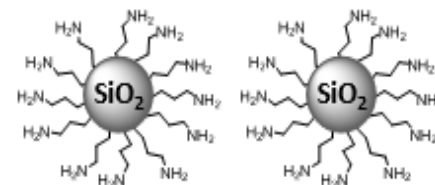


Figure: Schematic of amine functionalized silica nanoparticles

For more information:

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