EMRP Call 2010 - Industry & Environment

Topic number: SRT-01i

Title: Traceable quantitative surface chemical analysis for industrial applications

Abstract

Chemical and topographical metrology at surfaces is a horizontal scientific-technical field that underpins almost all subject fields in advanced engineering in industry. The establishment of new traceable measurement standards and reference materials for surface chemical analysis will be key for the next generation of instrumentation by European instrument manufactures. Test laboratories will benefit from the development of metrologically underpinned quantitative methodologies of measurements at surfaces. Also the development of more efficient, selective and cost-effective catalysts will require a better metrology with focus on surface effects.

Conformity with the Work Programme

This Call for JRPs conforms to the EMRP 2008, section on "*Metrology R&D for applied and fundamental metrology"* related to *Industry* on pages 41 and 42.

Keywords

surface chemical analysis, catalysis, amount of substance, film thickness, spectroscopy, 2D and 3D analysis, modelling and simulation, certified reference materials, standardisation, in-situ measurement, structure-activity relationship, chemical kinetics

Background to the Metrological Challenges

Many of the most advanced industries depend on accurate and traceable surface chemical analysis for product development, trade, the protection of intellectual property, and for quality control while a critical barrier in the development of innovative new catalysts is the ability to determine their microscopic physical and chemical structure and their behaviour under working conditions. A European metrology infrastructure providing validated methods and traceable reference materials for surface chemical analysis would enhance the capabilities of these industries to innovate and enable Europe's surface and microanalysis instrumentation makers to compete more effectively. The need for the development of standardised quantitative procedures for surface analysis is explicitly addressed in the business plans of ISO TCs 201 Surface Chemical Analysis and 202 Microbeam Analysis.

The composition of solid material surfaces is usually very different from that of the bulk and is often key to the way that the material behaves in its service environment. For instance bonding, wettability, cell adhesion and reactivity of components are all radically affected by this composition. Surface analysis has been important in the technology of microelectronics, coatings for optical, wear and other property enhancements, bonding and corrosion for aerospace and transport, protein adhesion and toxicity for body implants, polymer surface changes for construction work and drug delivery, etc. Correlation of local surface properties with chemical reactivity is an intrinsic step in gaining an improved understanding of catalytic processes and advanced tools for the characterisation of the physical and chemical properties of working catalysts and measurement of local catalytic activity will permit the development and optimisation of more efficient, selective and cost-effective catalyst materials.

EURAMET, EMRP-MSU
National Physical Laboratory
Hampton Road, Teddington,
Middlesex, TW11 0LW, UK

Phone: +44 20 8943 6666
emrpA169@npl.co.uk
www.euramet.org

The EMRP is jointly funded by the EMRP participating countries within EURAMET and the European Union

Scientific and Technological Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them, in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the JRP-protocol.

The objectives of the JRP are to provide measurement standards and methods with traceability wherever it is practicable to do so for quantitative surface chemical analysis for industrial applications. This shall include the

1. development of Certified Reference Materials with known and stable surface chemistries as well as with defined thickness and lateral structure for instrument calibration and verification of industry-relevant surface chemical measurements.
2. development of new fast non-destructive methods of quantitative surface chemical analysis for industrial in-line quality control. In particular this should include the development of advanced techniques for real time, in-situ measurement of catalyst structure and activity on a localised scale to underpin the development of more efficient, selective and cost-effective catalysts.
3. development of metrological methods including development of Certified Reference Materials to improve the capability of technologies widely used in industry for surface analysis such as electron and fluorescence spectroscopy, X-ray reflectrometry, electron probe microanalysis or ion mass spectrometry.

Proposers shall give priority to work that meets documented industrial needs and that which supports transfer into industry e.g. by cooperation and/or by standardisation.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community. This may be through the inclusion of unfunded JRP partners or collaborators, or by including links to industrial/policy advisory committees, standards committees or other bodies. Evidence of support from the “end user” community (eg letters of support) is encouraged.

Where a European Directive is referenced in the proposal, the relevant paragraphs of the Directive identifying the need for the project should be quoted and referenced. It is not sufficient to quote the entire Directive per se as the rationale for the metrology need. Proposals must also clearly link the identified need in the Directive with the expected outputs from the project.

You should also detail other Impacts of your proposed JRP as detailed in the document “Guidance for writing a JRP”

You should detail how your JRP results are going to:

- feed into the development of urgent standards through appropriate standards bodies
- transfer knowledge to the engineering, chemical and instrumentation sectors
- generate, and make available, new Certified Reference Materials.

You should also detail how your approach to realising the objectives will further the aim of the EMRP to develop a coherent approach at the European level in the field of metrology. Specifically the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of Member States and countries associated with the Seventh Framework Programme whose metrology programmes are at an early stage of development to be increased
- outside researchers & research organisations other than NMIs and DIs to be involved in the work

Time-scale

The project should be of 3 years duration.