

Project 4

Measurement of Lateral Resolution of Raman Microscopy with Nanowire Artefacts

Objectives

This project will assess the performance characteristics of a method for measuring lateral resolution in Raman microscopy through an Interlaboratory Comparison. The proposed method uses traceably characterised nanowires as calibration artefacts.

Background

Raman microscopy is a widely used technique for chemically sensitive mapping of samples. This is typically achieved by coupling a Raman spectrometer with a confocal microscope and scanning across a sample of interest to construct a pixel-by-pixel image.

The spatial resolution of Raman microscopy is an important parameter for characterising the performance of an instrument as well as for quantitative description of sample features. However, such measurements of spatial resolution require suitable artefacts, which are yet to be developed.

Specifically, this project will consider lateral resolution measurements using inorganic nanowires and the line-spread function (LSF) method. A unique feature of these samples is that individual

nanowires can be easily and uniquely identified, which enables traceable characterisation with metrological atomic force microscopy (AFM).

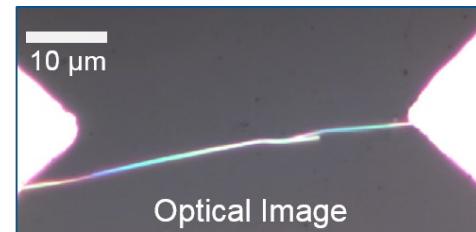
Standardisation Needs

Existing standards (ISO 18337:2015, ISO 18516:2019) relate to the determination of lateral resolution in general, and also to the specific case of measurement of lateral resolution for confocal fluorescence microscopy, which is closely related to confocal Raman microscopy. These standards describe general and specific requirements of artefacts for lateral resolution methods, but do not address suitability for Raman measurements.

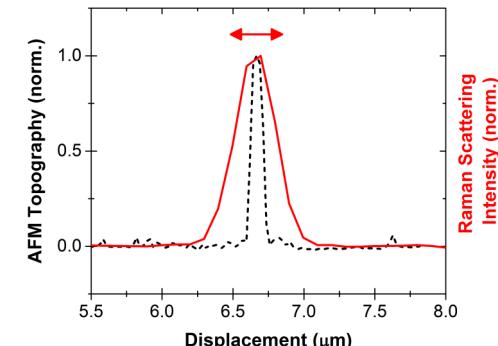
Work Programme

- Develop protocol and finalise artefact design
- Prepare samples for round-robin
- Traceable dimensional characterisation at NPL
- Round-robin interlaboratory measurements
- Data analysis, evaluation and reporting

CALL FOR PARTICIPATION



Optical microscope image showing example of isolated inorganic nanowire artefact.



Raman scattering intensity profile across nanowire of known dimension provides a measure of lateral resolution.

Deliverables and Dissemination

Report will evaluate the suitability of candidate physical standard and guide further development. Results will be published in peer-reviewed journals and are expected to contribute to a documentary standard under ISO TC 201.

Funding

This activity has been initiated through the EMPIR 16ENG03 HyMet project. Participants in the interlaboratory comparison will fund their own involvement (approx. 3 days' work).

International Participation

Current participants represent the UK, France, Denmark, Italy, Germany, USA, Canada, Brazil, Korea, Japan and China.

For more information on participation, please contact:

Dr. Sebastian Wood

Dr. Fernando Castro

Project Leaders

National Physical Laboratory, UK

Email: sebastian.wood@npl.co.uk

Email: fernando.castro@npl.co.uk

Erlon H Martins Ferreira

Chair, VAMAS TWA 42

Inmetro, Brazil

Email: ehferreira@inmetro.gov.br