VAMAS Strategic Activity (TWA 0 /Project 3)

Assessing self-assembling characteristics of DiBlock Copolymers (DBC) nanostructures

Objectives

The aim of this international interlaboratory comparison is to establish a metrological framework for the development of sub 50 nm self-assembled nanomaterials for electronic and optical applications.

This includes the **periodicity assessment of self-assembled block copolymers** measuring the lateral length (periodicity), and correlate these to measurements of lateral length using alternative techniques. This work is undertaken as part of the EMPIR project **20FUN06 MEMQuD.**

Measurement Techniques

- Scanning Electron Microscopy (SEM)
- Atomic Force Microscopy (AFM)
- Grazing-Incidence Small-Angle X-ray Scattering (GISAX)

Background

DBC are widely used in microelectronics and in applications related to nanolithography on large area and surface patterning. The periodicity of DBC nanostructures is an important indicator of the self-assembly process history and the final characteristics.

The currently available standards for lateral length measurement are too large and their uncertainty level is not acceptable for the increasing needs of metrology.

Furthermore, no periodic structures are currently available as a lateral length standard with period below 50 nm but above typical lattice spacing in the range of 1 nm.

Standardisation Needs

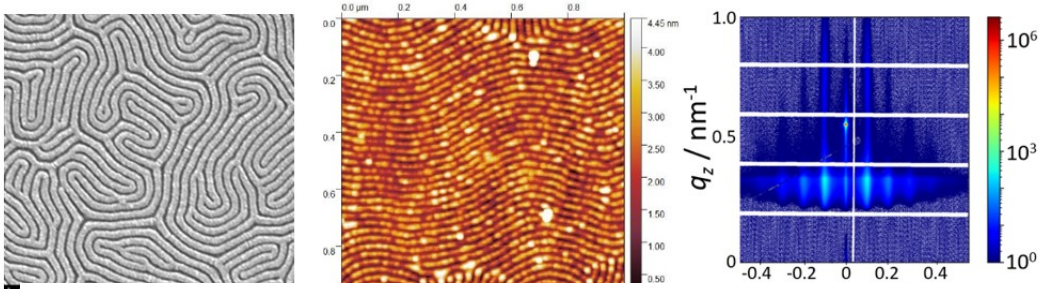
Industry and calibration laboratories need step height and lateral length standards at the nanometric level for resolution certification of a variety of measuring instruments, such as scanning probe microscopes (SPM), optical phase shift microscopes, and scanning electron microscopes (SEM).

Commercially available standards in this range of length consist of a small chip containing a single isolated line 4 mm long. The width of the line is certified by TEM analysis and used as a reference standard. The smallest line width ranges from 110 to 25 nm.

Work Programme

- Develop a calibration procedure with traceability, combining experimental data from different characterization techniques.
- Evaluate measurement uncertainty.
- Development of standardized procedures to define the geometry and material properties of the nanostructures.

CALL FOR PARTICIPATION



Scanning Electron Microscopy, Atomic Force Microscopy microphotos and Grazing Incidence Small Angle X ray analysis of DiBlock Copolymers nanostructures.

Deliverables and Dissemination

- Report will evaluate the variance observed of the associated measurement protocol, to guide further development.
- Results will be published in a peer-reviewed journal.
- Any validated data generated will be proposed to the relevant standards committees to be considered for development of future international standardisation.

Funding

Participants fund their own involvement in the project. Materials for the interlaboratory comparison will be supplied by INRiM.

References

1. B. Beckhoff *Nanomaterials* **2022**, 12 (13), 2255

2. F. Ferrarese Lupi et al. *ACS Appl. Mater. Interfaces* **2017**, 9, 18, 15685–15697

International Participation

INRiM (Italy) - Istituto Nazionale di ricerca Metrologica
PTB Berlin (Germany)
Tubitak (Turkey)
DESY (Germany)
IMEC (Belgium)
IMDEA (Spain).

Current participants represent EU. Wider global participation would be greatly welcomed.

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