



VAMAS

## Graphene and Related 2D Materials

Technical Work Area 41

### Project 13

### Lateral size of graphene oxide flakes by Scanning Electron Microscopy (SEM)

#### Objectives

The aim of this international interlaboratory comparison is to determine the lateral size distribution of graphene oxide flakes using Scanning Electron Microscopy (SEM).

The results will be used directly for further development of the [ISO/AWI TS 23879](#) with a validated measurement procedure.

This work is undertaken as part of the EMPIR project [ISO-G-SCoPe](#).

#### Background

Graphene is predicted to impact many different application areas such as solar cells, biosensors, displays, composites, flexible electronics and energy storage due to its exceptional properties. One of graphene's many achievements is that it is the first truly 2D material, being only 1 atom thick. The isolated research into a whole new family of other 2D materials has indicated that the new materials show exciting and complementary properties to graphene, revealing potential for many other industry applications.

#### Standardization Needs

As industry uptake on this material increases, international standardization is critical to enable commercialization. Reliable, accurate, and reproducible

measurements are important due to the multiple production routes and producers of the material in order to maintain quality in manufacture.

Several standards are under development within ISO/TC 229 'Nanotechnologies', jointly with IEC,

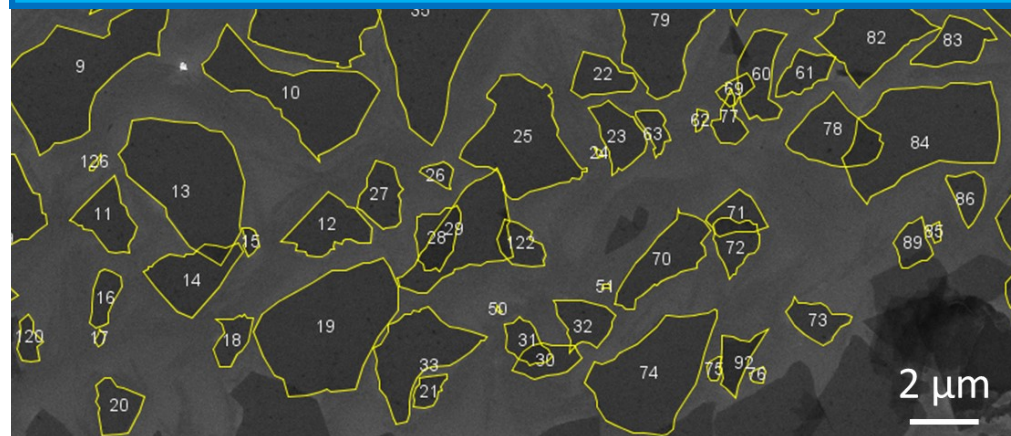
- [ISO/AWI TS 23879](#)  
Structural characterization of graphene oxide flakes: thickness and lateral size measurement using AFM and SEM
- [ISO/AWI TS 23359](#)  
Chemical characterization of graphene in powders and suspensions", which focus on determining the dimensional and chemical properties of graphene-related 2D materials.

This requires interlaboratory comparisons to develop best practice and understand the associated measurement uncertainties.

#### Relevant Standards Committees

ISO/TC 229 Nanotechnologies  
ISO/TC 202 Microbeam analysis  
ISO/TC 201 Surface analysis

## Call for Participation



SEM image after manual contouring of graphene oxide flakes

#### Work Programme

Graphene oxide sheets from liquid suspension transferred onto silicon wafer will be measured with an SE InLens detector in an SEM, according to a protocol including the image analysis approach and the size descriptors to be measured and reported. Samples will be prepared by the project leadership and provided to each participant.

The project is due to start in May 2023 for a duration of 12 months.

#### Deliverables and Dissemination

This interlaboratory study will be disseminated in a peer-reviewed scientific journal, and used to develop [ISO/AWI TS 23879](#) "Structural characterization of graphene oxide flakes: thickness and lateral size measurement using AFM and SEM".

#### Funding

Participants will fund their own involvement (approx. 4 days' work).

#### International Participation

Current participation includes Australia, Brazil, China, USA, Japan, and European countries. Additional participants welcome.

#### For more information:

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