



# Graphene and Related 2D Materials

Technical Work Area 41

## Project 3 Chemical composition of G/GO flakes: Elemental analysis and Oxygen content using X-ray photoelectron spectroscopy (XPS)

### Objectives

This project aims to:

- validate methodology for measuring the elements, especially carbon and oxygen content of graphene (G) and graphene oxide (GO) flakes in a powder form, using X-ray photoelectron spectroscopy (XPS).
- Determine the uncertainties associated with the measurement and data analysis.

### 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 two-dimensional 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 industrial applications.

### Standardization Needs

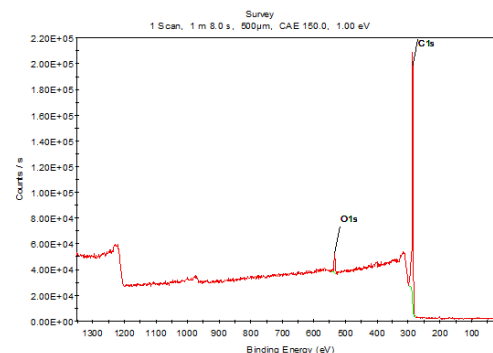
As industry uptake on this material increases, international standardization is critical to enable commercialization. Reliable, accurate and reproducible measurements are important in order to maintain quality, considering that there are multiple production routes and producers of the material.

Several standards are under development within ISO TC 229 'Nanotechnologies', jointly with IEC TC 113, that are focused on the measurement of specific properties of graphene produced through different methods. There is currently a need for measurement standards that address the determination of chemical properties including main elements, oxygen content and C/O ratio.

### Work Programme

The graphene (G) and graphene oxide (GO) will be sourced by the

## Call for Participation



- VAMAS Technical Report
- Report to ISO/TC229 or IEC/TC113 for consideration towards future international standardization.

### Funding

Participants fund their own involvement in the project.

### Project Status

This project is due to start in December 2017 for a duration of 6 months.

industrial collaborators. Functionalized and non-functionalized G and GO flakes will be used.

Main elements, oxygen content and C/O ratio are to be measured.

The samples will be prepared and dispatched to each participating laboratory by the project leader.

### International Participation

Current participation includes volunteers from Australia, Brazil, China, France, Spain, UK and USA. More participants are welcome.

### Deliverables and Dissemination

- Development of measurement methods for the main elemental analysis, oxygen content and C/O ratio in G and GO flakes.

To register your interest to participate, please contact:

#### Dr. Lingling Ren

Co-Chair, VAMAS TWA 41  
National Institute of Metrology, China  
Email: [renll@nim.ac.cn](mailto:renll@nim.ac.cn)

#### Dr. Renxiao Liu & Guanglu Ge

Project Leaders  
National Center for Nanoscience and Technology, China  
Email: [liurx@nanoctr.cn](mailto:liurx@nanoctr.cn)  
[gegl@nanoctr.cn](mailto:gegl@nanoctr.cn)

[www.vamas.org](http://www.vamas.org)

November 2017