



## Joint Workshop of IEC/TC 113 and EMPIR GRACE on the electrical characterization of graphene

Graphene is being extensively investigated by industry as a potential new material for electronics. For graphene to be adopted as an electronic industrial product, accurate and reproducible characterization methods adapted to the 2D nature of graphene are crucial. But such electrical characterization methods for graphene are presently underdeveloped; and guidelines for the proper implementation of such methods in an industrial environment are lacking. This issue is currently being addressed in the EMPIR project GRACE.

**GRACE** (Developing electrical characterisation methods for future graphene electronics) is a project within Euramet's EMPIR program. It deals with the development and comparison of methods for the electrical characterisation of graphene to support standardized measurements. The methods comprise contact and non-contact and high-speed measurements.

The **IEC Technical Committee TC 113** "Nanotechnology for electrotechnical products and systems" develops standards regarding components or intermediate assemblies that are created from nano-scale materials and processes for electrical or electro-optical applications. Specific topics include terminology, measurements, characterization, performance, reliability, safety and environment issues.

We are pleased to invite you to the joint Workshop of GRACE and IEC/TC 113 which will be held during the IEC/TC 113 spring meeting

on Wednesday, **May 22 2019, 2:00 – 6:00 pm**

at the **Instituto de Ciencia de Materiales de Madrid – ICMM – CSIC**  
**Calle Sor Juana Ines de la Cruz, 3**  
**28049 Madrid, Spain.**

The objective of the workshop is to initiate a discussion between the GRACE consortium and its stakeholders. As part of the project, two Good Practice Guides on the electrical characterization of graphene (see agenda below) are being developed. These Guides will be presented and used as a starting point to consider how to translate the project's findings into standardization activities.

We would be happy to welcome you to the workshop.

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### Registration

If you are a member of IEC/TC 113, please register using the official registration form distributed with the invitation for the IEC meeting.

Otherwise please contact Alexandra Fabricius ([Alexandra.Fabricius@vde.com](mailto:Alexandra.Fabricius@vde.com)) until **May 6, 2019**

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## Agenda

Wednesday, May 22, 2019

- 14:00**      **Welcome**
- 14:15**      **Introduction to the project**
- 14:30**      **Good Practice Guides on Contact Methods**
- In-line 4-point probe method
  - van der Pauw method
  - CoPlanar Waveguide (CPW) method
  - Electrical Resistance Tomography (ERT)
- 16:00**      **Coffee Break**
- 16:30**      **Good Practice Guides on Non-contact Methods**
- Scanning Kelvin Probe Microscopy
  - Terahertz Time-Domain Spectroscopy
  - Microwave Resonant Cavity Technique (NPL setup)
  - Microwave Resonant Cavity Technique (NIST setup; IEC TS 62607-6-4)
- 18:00**      **End of Meeting**

## Project Consortium

