GRACE NEWSLETTER

16NRM01 | EMPIR | GRACE

Impact Highlights

Journal Papers
- ACS Sensors [1]
- ACS Applied Materials & Interfaces [2]
- 2D Materials [3]
- Communications Physics [4]

Major Conferences
- CPEM 2018
- Graphene Week 2018
- Graphene2018 Conference

Standardisation
Interaction with IEC/TC113

GRACE Website
http://empir.npl.co.uk/grace

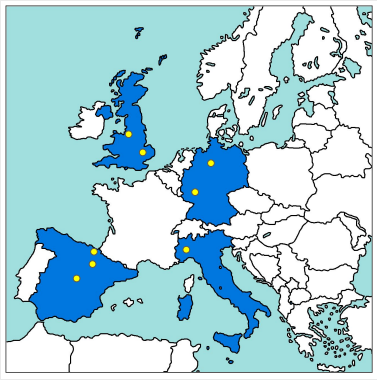
Consortium

Partners:

INRIM, NPL, UoM, CEM, Graphenea, das-Nano, VDE, ISC.

Collaborators:

Politecnico di Torino



Stakeholders:

NIST (US), FORTH (GR), Universidad de Salamanca (SP), Graphene-XT (IT), Gofaster (IT).

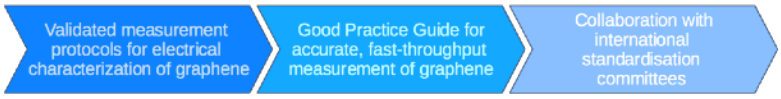
EMPIR
The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States
EURAMET

Developing electrical characterisation methods for future graphene electronics

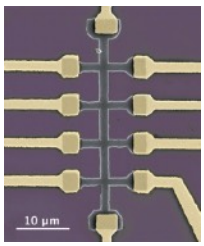
The GRACE project

The adoption of graphene as an electronic industrial product is currently limited by the inability to grow large areas of high-quality graphene with uniform and reproducible electric and electronic properties.

The GRACE project roadmap



The GRACE project, now at month 18 of its span, is making possible accurate and reproducible electrical characterisation methods suitable for graphene, both as test samples and in production lines.



Key Control Characteristics (KCC) of CVD graphene samples from cm- to wafer-size samples have already been successfully measured and cross-validated by the partners.

The project consortium includes National Metrology Institutes, Research Institutions, Standardisation Bodies, Industrial partners active in production, characterisation and normative consulting.

Mid term meeting

The **GRACE mid-term meeting** took place on September 14 2018 at Graphenea (San Sebastian, Spain). The meeting involved presentations from the work packages leaders and a scientific workshop for the stakeholder committee with open discussion. A visit of the Graphenea labs took place in the same day.

Next Events

22 May '19

IEC meeting in Madrid. An open session of the IEC stakeholders is scheduled. GRACE partners will present the Good Practice Guides for the characterization of electrical KCC of graphene.

23-27 Sept. '19

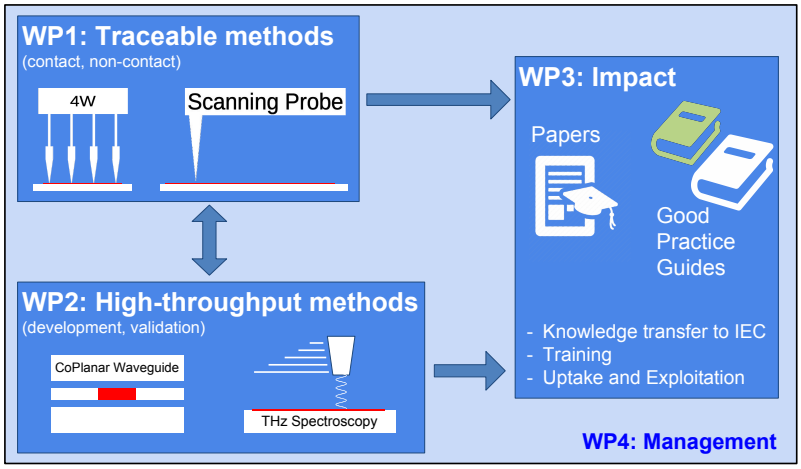
Graphene Week in Helsinki. The GRACE "industry friendly workshop" will take place within the Graphene Flagship conference.

Contacts: a.cultrera@inrim.it

The newsletter has been realised within the Joint Research Project 16NRM01 GRACE: Developing electrical characterisation methods for future graphene electronics. This project has received funding from the EMPIR programme co-financed by the Participating States and from the European Union's Horizon 2020 research and innovation programme.

Project advances

The partners have already compared several non-contact methods[1] with contact methods[2] for the measurement of electrical conductivity on CVD graphene samples in a round-robin experiment. For example THz spectroscopy (non-contact optical method) has been successfully compared with electrical resistance tomography (contact, electrical method). As shown in the figure the match between these two methods is very good. Latest results are under review in major journals.



References:
[1] *ACS Sens.* 2018, 3, 9, 1666-1674.
[2] ACS Appl. Mater. Interfaces 2018, 10, 37, 31641-31647.
[3] C Melios *et al* 2018 *2D Mater.* **5** 022001.
[4] Communications Physics **1**:83 (2018)

[1] Kelvin probe, THz spectroscopy, microwave resonance.

[2] 4-inline probe, van der Pauw, Electrical Resistance Tomography, microwave coplanar waveguides.