



IEC TC 113
Nanotechnology for
electrical and electronic
products and systems

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Secretary

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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- Background
 - Liaisons
 - Graphene work
 - US stakeholder involvement



TC 113 History

- IEC Advisory Group formed to consider new area of standardization work in nano-electrotechnology in light of growth in nano-enabled electronics
- IEC established new TC 113 in 2006
- First plenary meeting in Frankfurt in 2007



TC 113 Priorities

- Determine top standardization needs in the market
- Establish liaisons with TC's and allied organizations
- First deliverable – Blank detail specification for CNT's



TC 113 Working Group Structure

- JWG1, Terminology
- JWG2, Measurement and characterization
- WG3, Performance assessment
- WG7, Reliability assessment



TC 113 Working Group Structure

- WG8, Graphene related materials, CNT materials
- WG9, Nano-enabled photovoltaics, thin film organic nano-electronics, nanoscale contacts and interconnects
- WG10, Luminescent nanomaterials
- WG11, Nano-enabled energy storage



TC 113 Liaisons

- ISO TC 229, Nanotechnologies (JWG1, JWG2)
- IEC TC 1, Terminology (JWG1)
- IEC TC 21, Secondary cells and batteries (WG11)
- IEC TC 47, Semiconductor devices
- IEC TC 82, Solar photovoltaic energy systems (WG9)
- IEC TC 119, Printed electronics
- IEEE, SEMI, ANF



Blank detail specifications

- IEC 62565-3-1, Nanomanufacturing – Material specifications, Part 3-1, Blank detail specification for graphene for electrotechnical applications
(Committee Draft (CD) stage)
- IEC 62565-3-2, Nanomanufacturing – Material specifications, Part 3-2, Sectional blank detail specification for nano-ink
(Potential work item (PWI) stage)



Detail specifications

- IEC/TS 62565-3-3, Nanomanufacturing – Material specifications, Part 3-3, Detail specification for single-layer graphene (PWI)
- IEC/TS 62565-3-4, Nanomanufacturing – Material specifications, Part 3-4, Detail specification for bi-layer graphene (PWI)



Key control characteristics

- IEC/TS 62607-6-1: Graphene - Measurement of sheet resistance of commercial graphene powders by the Four Probe Method (**approved work item**)
- IEC/TS 62607-6-2: Graphene – Evaluation of the number of layers of graphene (**approved work item**)
- IEC/TS 62607-6-3: Graphene-Characterization of CVD graphene domains (**CD**)



Key control characteristics

- IEC/TS 62607-6-4: Graphene - Surface conductance measurement using resonant cavity (**published**)
- IEC/TS 62607-6-5: Graphene sheet resistance and contact resistance measurement using the transmission line method (**PWI**)
- IEC/TS 62607-6-6: Graphene - Uniformity of strain in graphene analyzed by Raman spectroscopy (**PWI**)



Key control characteristics

- IEC/TS 62607-6-7: Determination of specific surface area of graphene materials using methylene blue adsorption method (PWI)
- IEC/TS 62607-6-8: Graphene - Measurement of sheet resistance by the four-point probe method (PWI)
- IEC/TS 62607-6-9: Graphene - Measurement of sheet resistance by the non-contact Eddy current method (PWI)



Key control characteristics

- IEC/TS 62607-6-10: Graphene - Measurement of sheet resistance by terahertz time-domain spectroscopy (PWI)
- IEC/TS 62607-6-11: Graphene - Defect level of graphene analyzed by Raman spectroscopy (PWI)
- IEC/TS 62607-6-13: Determination of content of functional group of graphene materials using Boehm's titration method (PWI)



Key control characteristics

- IEC/TS 62607-6-14: Graphene - Defect level analysis of graphene powder using Raman spectroscopy (PWI)
- ISO/TR 19733: Matrix of characterization and measurement methods for Graphene (PWI)
- ISO/TS 80004-13: Nanotechnologies - Vocabulary - Part 13: Graphene and other two dimensional materials (Draft Technical Specification (DTS) stage)



Participate!

- Standards drive markets, so drive the standards!
- Manufacturer and customer stakeholders are critical
- Join the TC 113 TAG





Thank you!

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