INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

IEC/TC 113: NANOTECHNOLOGY STANDARDIZATION FOR ELECTRICAL AND ELECTRONIC PRODUCTS AND SYSTEMS

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Driving forces for standards development

- Electrical and Electronic products that are nano-enabled
  - Huge growth, estimated by Lux Research and others ($1T nano-enabled products in 2015)
  - Exciting growth of activity in TC 113 as nano-enabled products are brought to the market
- Product families presently being worked on
  - Photovoltaics (organic) (focus on reliability, lifetime, performance, …)
  - Li-ion batteries (performance evaluation of nano-cathode materials)
  - Lighting (QDs, calcium chalcogenide QD detailed specification)
  - Wire & Cable (Corona resistance of dielectric coatings of wires) (performance of Inverters in the PV or Smart Grid arena)
  - Printed Electronics (nano-inks)

Driving forces for standards development, continued

- Nanotechnologies presently being worked on (horizontal penetration potentially large)
  - Semiconductor nano-scale contacts and interconnects
  - Graphene (transparent electrodes, interconnects) (what parameters are crucial, how to measure?)
  - Surface coatings using nanomaterials (quality assessment)
- Industry needs
  - Manufacturing processes
  - Blank and detailed material specifications (for producers and users)
  - Performance & Reliability characterization
  - Quality of nanomaterials

Prioritization process

- National Committees bring project suggestions to TC 113
  - TC 113 considers alignment and appropriateness of project
    - relationships with ISO TC 229 are considered
  - A leader and technical experts are requested and assigned from National Committees
  - Projects begin
- Comments
  - There is no limit on the work assuming that there are sufficient experts to do the work
  - Work generally aligns with survey from 2008-9 that identified major product areas in need of standards

Nanotechnology Growth History

- From Chemistry World, Mar2011, p 47, www.chemistryworld.org
  - Summary of Dec2010 NNI Celebration of 10 years
    - WW investment of $42B
    - USA invested $30M/yr between 1994-8
    - USA had fragmented investment in the 1990s
    - Clinton and NSF launched 'tiny little initiative' called NNI, 1999
    - By 2008, USA $5.1/capita/year, EU $4.6/capita/year, Koreans $6.0/capita/year, and Japan $7.3/capita/year.
    - In 2008, Global Venture capital investment $1.4B/year
    - Number of Researchers estimated at 400,000 in 2008 **(EXPERTS?)**
      - 65,000 scientific citations; 13,000 patents
    - LUX estimates $254B of nano-enabled products in 2009 (and Doubling every 3 years!)
    - **LUX estimates $1T of nano-enabled products in 2015**.

Challenges for Standards Development and Use

- Technical Experts (a volunteer-dependent system)
  - Researchers, citations, patents, and projected nano-enabled product revenue streams
    - Should generate >0.1% 'expert' participation?
  - Why is there insufficient support for standards development?
- Coordinating meetings globally
  - Face-to-face meetings (cost, time, in-kind corporate support)
    - Should the government funding agencies help? Can they?
  - Webinars/teleconferences (time-zone limited)
  - Value proposition to corporations and employees not clear
- Corporate IP/know-how protection
  - Do corporations want to disclose their 'novel technology' to a standards body?

Additional Challenges for Standards Development and Use

- Building synergy with other standards bodies
  - Communications and alignment (we need each other)
    - Coordination with others involves ‘relationships’ that require investments of time
  - Segmentation of IEC TCs
    - Product TCs like lighting, batteries, displays, etc.
      - No roadmaps from Product TCs that highlight nanotechnology use
    - New horizontal TCs like TC 119 Printed Electronics
      - Secretariat of TC 119 was a very active member of TC 113
- Technological
  - Nano-contacts and nano-interconnect
  - Nano-labeling
  - Full disclosure of nano content
    - an environmental and safety requirement