STRATEGIC BUSINESS PLAN (SBP)

IEC/TC OR SC:	SECRETARIAT:	DATE:
113	**Germany**	**2015-12-01**

A. STATE TITLE AND SCOPE OF TC

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Title: TC 113 – Nanotechnology for electrotechnical products and systems

Scope: Standardization of the technologies relevant to electrotechnical products and systems in the field of nanotechnology in close cooperation with other committees of IEC and ISO.

Note: Nanotechnology will be used in a wide variety of applications. The standard deliverables will focus on components or intermediate assemblies that are created from nano-scale materials and processes for electrical or electro-optical applications. Potential applications include, in part: Electronics; optics; magnetics; electromagnetics; electro acoustics; multimedia; telecommunications; and energy production (direct conversion into electrical power as in fuel cells, photovoltaic devices and storage of electrical energy). Specific topics include terminology, measurements, characterization, performance, reliability, safety and environment issues.

A.2 WORKING AND ADVISORY GROUPS OF TC

JWG 1: Terminology and nomenclature

Task: Define and develop unambiguous and uniform terminology and nomenclature in the field of nanotechnologies to facilitate communication and to promote common understanding.

JWG 2: Measurement and characterization

Task: The development of standards for measurement, characterization and test methods for nanotechnologies, taking into consideration needs for metrology and reference materials.

WG 3: Performance assessment

Task: To develop standards for the assessment of performance, reliability, and durability related to the nanotechnology-enabled aspects of components and systems in support of continuous improvement at all stages of the value adding chain. WG 3 considers market demand and technology pull with an emphasis on fabrication, processing and process control, disposal, and recycling.

AG 4: Chairman Advisory Group (CAG)

Terms of Reference: The IEC TC/113 Chairman's Advisory Group (CAG) is established[1] to assist the chairman in tasks concerning coordination, planning and steering of the committee's work or other specific tasks of an advisory nature. The results of the CAG shall be presented in the form of recommendations to the IEC TC/113.

1 According to the IEC/ISO directives, part 1, clause 1.13

AG 5: Advisory Group on Environment, Health and Safety (EHS) (Disbanded)

ns of Reference: IEC/TC 113 has a close liaison with ISO/TC 229. This liaison ensures a direct link to ISO/TC 229/WG 3 on health, ty and environmental aspects of nanotechnologies. If special requirements from the electrotechnical industry regarding the EHS e occur in the future, IEC/TC 113 can react and initiate a new project in ISO/TC 229/WG 3 if necessary. IEC/TC 113 also has a liaison ı IEC/TC 111 on Environmental standardization for electrical and electronic products and systems. Regarding future regulation it is ortant to follow the work of the OECD Working Party of Manufactured Nanomaterials (WPMN). Advisory group 5 is responsible to nitor all the activities in these groups to advice IEC/TC 113 if action is required.

AG 5 was disbanded at the Milpitas meeting in 2012 because the expected need of the group was not confirmed. The task of AG 5 was transferred to a newly committed liaison officer to ISO/TC 229/WG 3.

AG 6: Advisory Group on Printed electronics (Disbanded)

Terms of Reference: Recently, printed electronics was identified as a potential new field of activity for IEC/TC 113 in the future. Even if printed electronic devices are physically large, companies often use nanomaterials and nanoprocesses for their manufacturing. Electrically functional inks have increasingly leveraged nanotechnology to formulate dispersions which can be deposited using traditional printing techniques. AG 6 is intended to evaluate standardization requirements and advice IEC/TC 113 how to proceed in this area in the future.

AG 6 was disbanded because the IEC decided to establish the new technical committee TC 119 on printed electronics. TC 113 and TC 119 identified a significant overlap of their technical responsibility especially in the material area because nanomaterials are widely been used in printed electronics. A close liaison with the secretaries as the liaison officers was established to prevent double work and inconsistent standards.

WG 7: Reliability

Task: To develop standards for the assessment of reliability in the field of nano electrotechnology. Focus is on failure mechanisms and failure modes related to the use of nanomaterials, material interfaces and nanoscale contacts under consideration of size dependent effects. Standards to be developed include test methods to identify failure mechanisms, determine lifetime, analyse failure effects and estimate durability of nano-enabled products. WG 7 provides the guidelines for the development of IEC/TC 113 standards on reliability assessment and approves those standards before they are circulated as a CDV.

WG 8: Graphene related materials, Carbon nanotube materials

Task: To develop standards within the area of carbon nanotube materials and graphene related materials Graphene related materials includes graphene and its modifications as well as other 2D materials. Those standards are intended to facilitate the assurance of quality and reliability of materials and intermediates, subject to the general concepts of blank detail specifications (BDS) and Key Control Characteristics (KCCs).

WG 9: Nano-enabled photovoltaics, Thin-film organic/nano electronics, Nanoscale contacts and interconnects

Task: To develop standards in the area of nano-enabled photovoltaics and organic electronics to facilitate the assurance of quality and reliability of materials and intermediates, subject to the general concepts of blank detail specifications (BDS) and Key Control Characteristics (KCCs).

Furthermore the WG is responsible for standardization in the area of nano-scale contacts and interconnects.

WG 10: Luminescent nanomaterials

Task: To develop standards within the field of luminescent nanomaterials, which include quantum dots, dye-incorporated matrix nanoparticles, up-conversion nanoparticles, rare earth luminescent nano-materials and others, with a focus on key control characteristics and test methods for performance, reliability, stability and others related to fabrication, processing and process control, disposal, recycling, etc.

WG 11: Nano-enabled energy storage

Task: To develop standards within the key nanotechnology area nano-enabled energy storage, to facilitate the assurance of quality and reliability of materials and intermediates, subject to the general concepts of blank detail specifications (BDS) and Key Control Characteristics (KCCs).

A.3 INTERACTIN WITH OTHER STANDARDS DEVELOPING ORGANIZATIONS (SDO)

IEC/TC 113 from the beginning tried to prevent competitive standardization activities of the SDOs dealing with nanotechnology by establishing liaisons and co-operations with those groups. The current relations are shown in figure A.3.1.

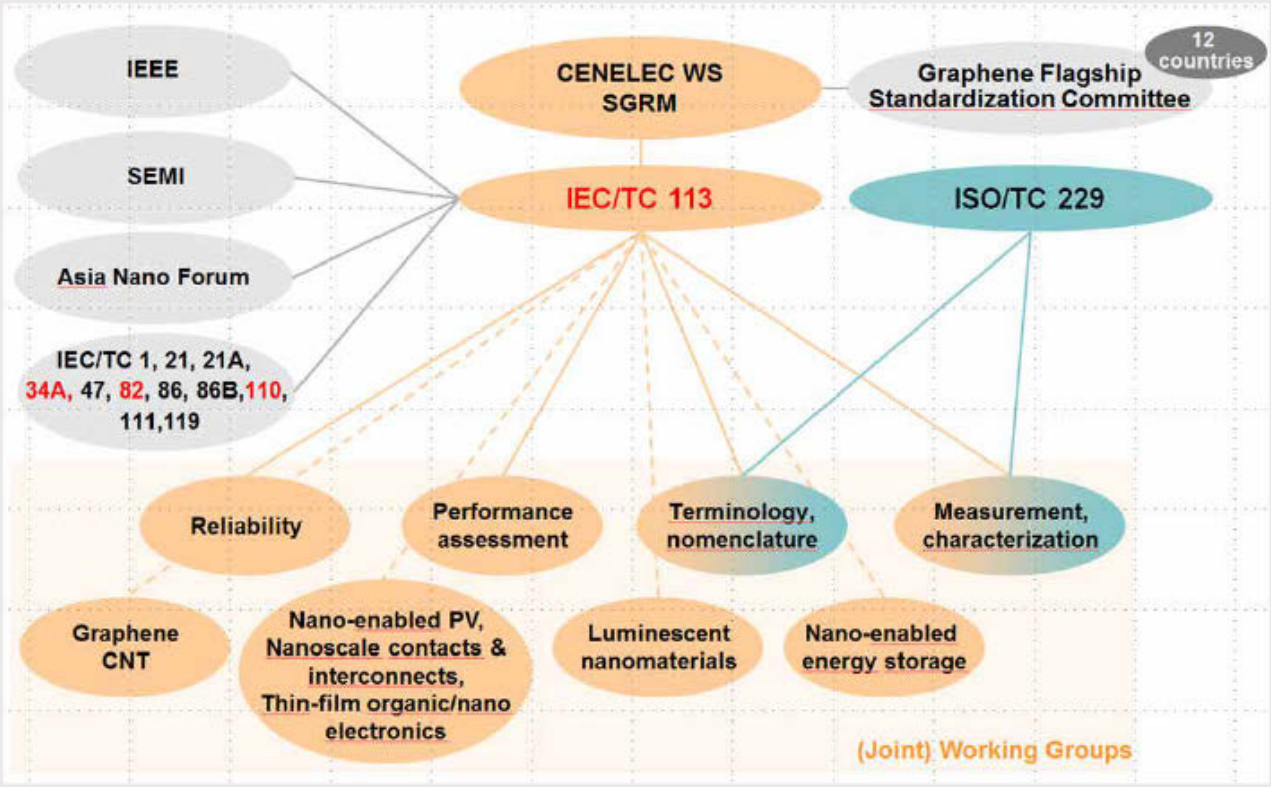


FIGURE A.3.1: Relations between IEC/TC 113 and other SDOs

Beside the liaisons to IEC and ISO committees there are D-Liaisons to IEEE, SEMI and ANF as well as an informal liaison to the CENELEC workshop on Specifications for Graphene Related Material - WS SGRM. The WS joins the standardization activities within the Future and Emerging Technology Flagship “Graphene” with the international standardization bodies IEC and ISO.

B. MANAGEMENT STRUCTURE OF THE TC

B.1 GENERAL

The standardization process in each key nanotechnology area revolves around central documents: The Blank Detail Specification (BDS). The BDS lists all relevant properties, the Key Control Characteristics (KCC), and the standardized measurement procedures to measure them. During the last years IEC/TC 113 developed a systematic for those standards (BDS: 62565-x-y; Measurement of KCC: 62607-x-y) to make them most useful for its stakeholders. Each standard is developed by experts from the addressed key nanotechnology to ensure the high quality of the content of the documents. Nevertheless it is important to ensure that the documents also fulfil the general concepts of IEC/TC 113. Therefore EC/TC 113 chooses a matrix organization structure addressing the identified key nanotechnologies and the basic concept of BDS and KCC. The double responsibility regarding the individual standardization projects shall ensure that on one hand the technical experts in a key nanotechnology meet together in one working group (WG 8, WG 9, WG 10, WG 11) and on the other hand the overall harmonization of projects regarding of a standardization area will be addressed (JWG 1, JWG 2, WG 3, WG 7). The current allocation of projects to WGs is shown in Table B.

B.2 CURRENT ALLOCATION OF PROJECTS TO WORKING GROUPS

		General	WG 8	WG 9	WG 10	WG 11
			Graphene related materials Carbon nanotube materials	Nano-enabled photovoltaics Thin-film organic/nano electronics Nanoscale contacts and interconnects	Luminescent nano-materials	Nano-enabled energy storage
AG 4	Cairman advisory group					
JWG 1	Terminology	ISO 80004-1 IEC 80004-9 ISO 80004-11 ISO 80004-12	ISO 80004-13			
JWG 2	Measurement and characterization		IEC 62565-3-1 IEC 62607-6-3 ISO 19733			
WG 3	Performance assessment	IEC 62565-1 IEC 62659 IEC 62844	IEC 62565-3-1 IEC 62565-3-2 IEC 62607-2-2 IEC 62607-2-4 IEC 62607-6-1 IEC 62607-6-2 IEC 62607-6-3 IEC 62607-6-4 IEC 62607-6-5	IEC 62607-5-2 IEC 62607-7-1	IEC 62565-4-2 IEC 62607-3-2	IEC 62607-4-2 IEC 62607-4-4 IEC 62607-4-5
WG 7	Reliability assessment			IEC 62876-2-1		

TABLE B.2.1: Current allocation of projects within the WG matrix

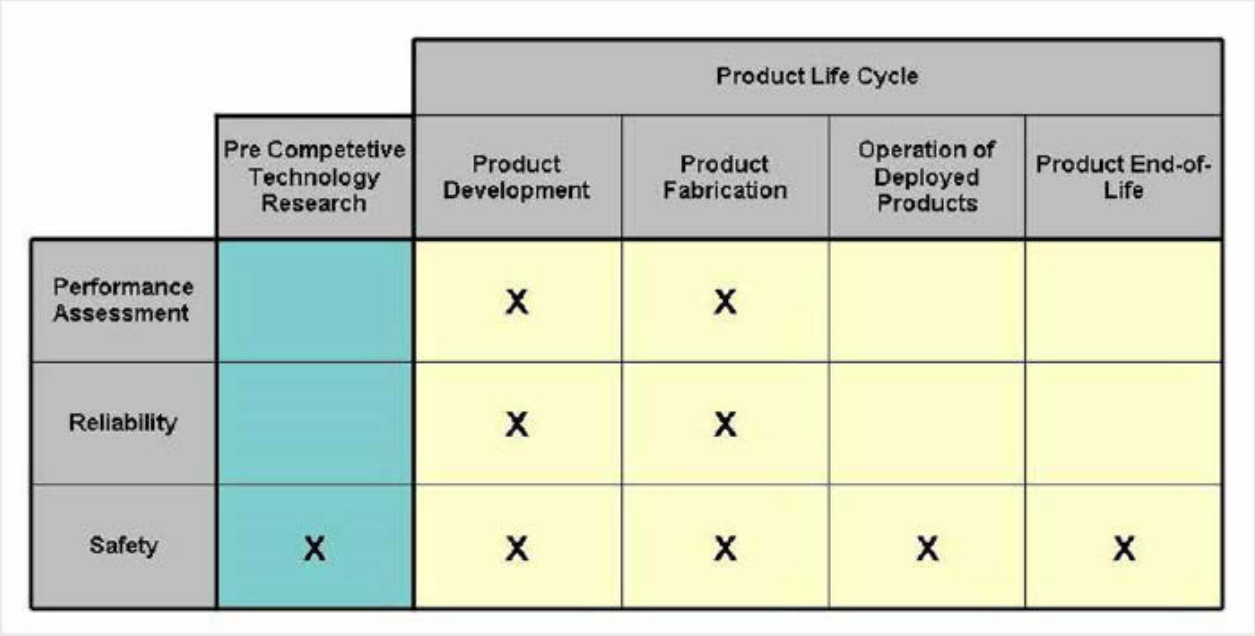
C. BUSINESS ENVIRONMENT

Nanotechnology is expected to be one of the key technologies of the 21st century. It provides opportunities for the development of new products with exceptional performance. Therefore, nanotechnology enables society to improve the quality of life through the use of nano-enabled products It is expected that nano-enabled products will emerge soon in energy production, efficiency and storage; electric vehicles; next generation consumer electronics; lighting and others.

D. MARKET DEMAND

The rapid growth of nanotechnology will demand standards as it penetrates the electrotechnical industry.

TC113 focuses on nanotechnology used in final products that incorporate nanotechnology in one or more of their subassemblies. TC113 produces standards, technical specifications and technical reports to guide manufacturers and customers. A particular focus of TC 113 is performance assessment, reliability and safety throughout the product life cycle, as shown in figure D.1.



	Product Life Cycle				
	Pre Competetive Technology Research	Product Development	Product Fabrication	Operation of Deployed Products	Product End-of-Life
Performance Assessment		X	X		
Reliability		X	X		
Safety	X	X	X	X	X

FIGURE D.1: TC 113 standards focus over the product life cycle

E. TRENDS IN TECHNOLOGY AND IN THE MARKET

E.1 GENERAL APPROACH

Nanotechnology is expected to enable the development of new products that are covered by many IEC TCs/SCs. An IEC Nanoelectronics Standards Roadmap will be the foundation for a standardization strategy for nano-electrotechnologies.

As a first step, a survey on standardization needs was conducted in 2008 in cooperation with NIST (USA), with input from technical experts worldwide.

A Project Team was authorized in 2009 to develop an IEC Nanoelectronics Standards Roadmap. The team has developed the first version of the roadmap and published it as an IEC Technical Report IEC/TR 62834 which will be updated regularly. The roadmap incorporates the survey results and publicly available product and technology roadmaps from around the world, as shown in figure E.1.1. It is the intent of TC 113 to focus its standardization activity in areas identified on the roadmap.

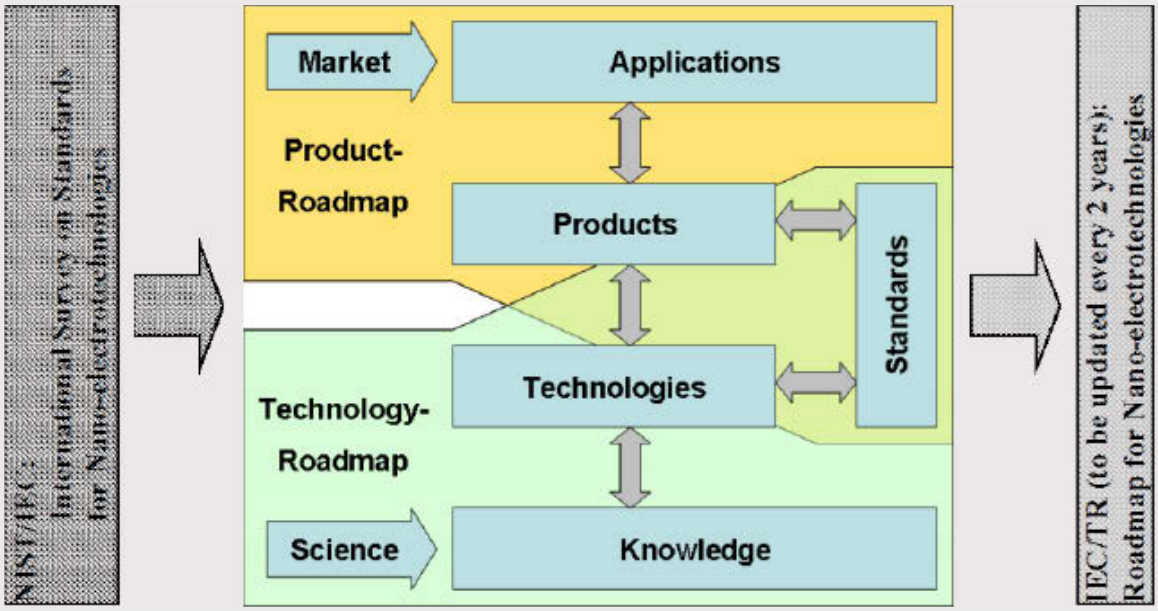


FIGURE E.1.1: TC 113 roadmap development process used to define standards activities

IEC/TC 113 was also involved in a technology foresight project of the IEC Market Strategy Board SWG 2 “Market and Technology Watch – Nanotechnology in the sectors solar energy and energy storage”. This project was intended to act as a pilot project for the IEC to support “systems-oriented standards development, as well as application-oriented goal solutions defined by the market”. Currently the final report is under publication. IEC/TC 113 appreciates the project because the methodology developed in the project seems to support the TC 113 strategy of anticipating standards development. Nevertheless due to its pilot character after the completed phase A (First report published) the project needs to be continued into phase B (Implementation into the regular work of TC 113) to ensure a sustainable effect to the future evolvement of the method for use in the IEC.

E.2 AREAS OF NANOTECHNOLOGY ADDRESSED BY IEC/TC 113

As a first result from the project TC 113 adopted the concept of technology profiles in their work by identifying the following mayor technologies as key technologies which requires standardization activities of TC 113:

- Luminescent nanomaterials
- Carbon nanotube materials
- Silver nanomaterials
- Graphene and related materials
- Nanoscale contacts and interconnects
- Technology profile "Organic and large area electronics
- Technology profile "Nano-enabled energy storage
- Technology profile "Nano-enabled photovoltaics

As a new field of work the area of nano-magnetism was identified. TC 113 started to evaluate this topic at the 2015 Seoul meeting with the establishment of a new PWI for spatially resolved local magnetic field measurements on the micrometer and nanometer scale.

E.3 MARKET TRENDS

Today strong research in nanotechnology takes place all over the world in order to create future innovative products. According to a recently published report of SEMI (Semiconductor Equipment and Materials International) in cooperation with SIA (Semiconductor Industry Association), the market for nanotechnology will grow from actual 1,8 Billion US$ to 4,2 Billion US$ in 2010. This indicates that nanotechnology has already penetrated the electronic industry and will be increasingly important in the future. During an NNI celebratory meeting in December 2010, the following statistics were cited for the time period 2000-2010:

- Worldwide investment in nanotechnology to date is $42B
- USA had fragmented investment in the 1990s
- USA invested $30M/yr. between 1994-2008
- President Clinton and NSF launched ‘tiny little initiative’ called NNI, 1999
- By 2008, investments in nanotechnology were: USA $5.1/capita/year; EU $4.6/capita/year; Korea $6.0/capita/year; and Japan $7.3/capita/year.
- In 2008, Global Venture capital investment was $1.4B.
- Number of Researchers estimated at 400,000 in 2008
- 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.

E.4 ECOLOGICAL ENVIRONMENT

TC113 takes part in work in this area, through its liaison with ISO TC 229/WG 3 Health, Safety and Environmental Aspects of Nanotechnologies, with appointed observers. At this stage, no working-group plan exists to produce standards or technical reports for the evaluation of risks for environment and human health due to the potential toxicity of individual nanomaterials, or for related test methods. However, as mentioned above, an Adhoc Group 5 was recently established by the CAG to focus attention on EHS issues, and to make recommendations to TC 113 on next steps to take.

Due to the absence of risk knowledge, implementation of precautionary procedures may be necessary in fabrication processes and during recycling and disposal of products at their end-of-life. This may require standards and other guideline documents which take into account the special situation and requirements for different products in different industries. Such guidelines for the electrotechnical industry and electrotechnical products are part of the scope of TC113 and will be developed in close cooperation with ISO TC229.

Liaison with TC111, Environmental standardization for electrical and electronic products and systems, will be established to prepare the necessary documents in the environmental area.

F. SYSTEMS APPROACH ASPECTS (REFERENCE - AC/33/2013)

TC 113 will actively continue to approach National Committees of IEC to participate on its work and to promote the establishment of liaisons to other committees; cooperation with system committees is still in its focus. TC 113 expects to approach the following TCs for potential co-operation

G. CONFORMITY ASSESSMENT

Not yet addressed

H. 3-5 YEAR PROJECTED STRATEGIC OBJECTIVES, ACTIONS, TARGET DATES

STRATEGIC OBJECTIVES 3-5 YEARS	ACTIONS TO SUPPORT THE STRATEGIC OBJECTIVES	TARGET DATE(S) TO COMPLETE THE ACTIONS
Increase the participation of IEC member countries	Secretariat to contact stakeholders in IEC member countries	2016-12-31
Motivation of technical experts to participate	Development of a system, to document individual participation in standards development projects	2016-12-31
Increase the visibility of IEC/TC 113	Presence of IEC/TC 113 on technical and scientific conferences	To be reported regularly at the plenary meeting

Note: The progress on the actions should be reported in the RSMB.