2017-09-26

Project Plan for the CEN Workshop on "Guidelines and best practices for sustainable production of carbon nanotube-based nano-enabled products (CNT-based NEPs)"

CEN/WS 89 'PLATFORM'

Workshop

1. Status of the Project Plan

This Project Plan was approved during the Kick-off meeting on 26 September 2017.

2. Background to the Workshop

PLATFORM is a research project funded by the European commission under the H2020 Framework Programme (PLATFORM[1] project, GA 646307). The purpose of the project is to efficiently and economically manufacture novel materials - carbon nanotube-based nano-enabled products (CNT-based NEPs) such as buckypapers, CNT treated doped prepregs and CNT doped non-woven veils - through the development of three new manufacturing pilot lines (PPLs) at a scale suitable for industrial production in sectors such as aerospace and automotive: Technology Readiness Level[2] TRL6 in 2018 and TRL9 (Putting into service) in 2020.

PLATFORM project has given continuity to three lab-scale pilot plants (TRLs between 4 and 5) conceived to develop strategies for the incorporation of CNTs into composite laminates developed in the framework of the European projects ELECTRICAL (GA-2010-265593) and SARISTU (GA-2011-284562). These initial pilot plants were conceived at a lab scale and currently can only manufacture small batches of CNT-based NEPs.

Pilot lines are the physical infrastructure and equipment needed to produce small series of pre-commercial products. They can drastically contribute to bridge the gap between nanotechnology research and markets, facilitate large scale market introduction of innovative, safe and sustainable nano-enabled products (NEPs) as well as provide pilot infrastructures and advisory services for small and medium-sized enterprises (SMEs) and start-ups, in order to maximize the impact of upscaling activities, boosting investment and facilitate market access. Thus they are essential tools for the strategic deployment of Key Enabling Technologies (KETs).

[1] http://www.platform-project.eu/
[2] https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf

Buckypapers are self-supporting sheets comprised of entangled carbon nanotubes. The PPL for buckypapers will have the capability to manufacture more than 40 m2/week of rolls of 300 mm width to any sub-multiples (150 mm, 75 mm width), with controllable thickness in the range of 30-80 µm (as customer demand) and a length of more than 100 m. The encapsulation of the buckypaper can be also configurable (as customer demand) from protective paper to resin or thermoplastic films in one or both sides of the product.

Prepreg are reinforcement carbon fiber materials which have been pre-impregnated with a resin system. CNT-doped prepregs are conventional carbon fiber prepregs doped with CNTs on it, in a way that are homogeneously distributed over the whole surface and deeply integrated on it. The current production capacity of this second PPL is established in 120,000 m2/ year. The format of the rolls can be the same as conventional prepreg (in width and length) or sub-multiples of these. The protective films can be the same that uses the conventional prepreg of any other different (as customer demand).

CNT-doped veils are non-woven thermoplastic textile materials containing CNTs, which can be easily used as interlayers in Carbon Fiber Reinforced Polymer (CFRP) composites. At this moment the CNT-doped veil pilot line can produce veils with 3.5 wt. % CNTs based on different thermoplastic polymers. The minimum areal weight is 15g/m2 with 0.5 m width and 1.9 m length. The current productivity of pilot line is 9,000 m2 veils/year.

All these CNT-based NEPs can be used for the manufacture of laminate composites materials with improved properties (e.g. light-weight, strength, antistatic, electromagnetic shielding), for the production of structural components and devices in the European aeronautics, automotive, military, medical and electronic industries.

The automation and re-design of several steps in the manufacturing process and the introduction of novel in-situ characterization methods and instrumentation for CNT-based NEPs will lead not only to a higher quality of the nanoproducts, but also to an increase in the yield and with shorter lead times. Final product cost will drastically reduce as a result of the decrease in production costs (particularly through reductions in both the energy consumption and raw materials). Thus composites with superior properties will be able to be manufactured using a large-scale production, ensuring at the same time that the impact on the safe and sustainability of new manufacturing processes will definitely be positive.

The new PPLs will not only provide increased capabilities to the operating company but also offer a network of nano-based manufacturing facilities suited to the needs of related SMEs. A European platform of CNT-based NEPs pilot lines will be established to which companies, and more precisely SMEs, can gain access and make use of the facilities as well as the experience and knowledge of the operating research & development organizations (RTOs).

PLATFORM will end in 2018 with the goal of demonstrate the overall feasibility and competitiveness of the new products and production technologies (Technology Readiness Level 6, TRL6). Thus a set of best practices and recommendations are required to guide this process in order to ensure the safety and sustainability of the new manufacturing processes.

Taking into account the EC recommendation included in Horizon 2020 (The European framework programme for R&D) regarding the transfer of project results into deliverables, the results of the PLATFORM Project will be transfered to the proposed CEN Workshop Agreement to disseminate these results to stakeholders.

Existing standards and other relevant references

The identified standardization activities currently developed by ISO and CEN related with the Scope of the WS are the following:

- EN ISO/TS 80004-3:2014 Nanotechnologies -- Vocabulary -- Part 3: Carbon nano-objects (ISO/TS 80004-3:2010) (CEN/TC 352 Nanotechnologies).
- CEN/TS 17010:2016 Nanotechnologies - Guidance on measurands for characterising nano-objects and materials that contain them (CEN/TC 352 Nanotechnologies)
- ISO/TR 10929:2012 Nanotechnologies -- Characterization of multiwall carbon nanotube (MWCNT) samples (ISO/TC 229 nanotechnologies)
- ISO/TS 11888:2011 Nanotechnologies -- Characterization of multiwall carbon nanotubes -- Mesoscopic shape factors (ISO/TC 229 nanotechnologies)
- CEN ISO/TS 13830:2013 Nanotechnologies -- Guidance on voluntary labelling for consumer products containing manufactured nano-objects (ISO/TC 229 nanotechnologies)
- CEN/TS 16937:2016 Nanotechnologies - Guidance for the responsible development of nanotechnologies (CEN/TC 352 Nanotechnologies).

Other relevant references are:

- Clark K, Van Tongeren M, Christensen FM, Brouwer D, Nowack B, Gottschalk F, Micheletti C, Schmid K, Gerritsen R, Aitken R,Vaquero C, Gkanis V, Housiadas C, López de Ipiña JM and Riediker M (2012) Limitations and information needs for engineered nanomaterial-specific exposure estimation and scenarios: recommendations for improved reporting practices. J. Nanopart. Res. 14 (9) (2012) 1–14.
- EC (2000) Communication from the Commission on the precautionary principle COM (2000) 1 final Brussels, 2.2.2000.
- EC (2015) Pilot production in Key Enabling Technologies. Crossing the Valley of Death and boosting the industrial deployment of Key Enabling Technologies in Europe. DG Internal Market, Industry, Entrepreneurship and SMEs, 27 pp.
- NANOCYL (2016) Material Data Sheets (http://www.nanocyl.com/product/)
- NANOREG2 (2016) H2020 - Project NanoReg2 (http://www.nanoreg2.eu/safe-design)
- NIOSH (2010) Prevention through design: plan for the national initiative. Pub. Nº 2011–121,44 pp.
- NIOSH (2013) Current strategies for engineering controls in department of health and human services nanomaterial production and downstream handling processes. Pub. Nº 2014–102, 79 pp.
- PLATFORM (2016) H2020 - Project Platform (http://www.platform-project.eu/)

3. Workshop proposers and Workshop participants

UNE as a partner of PLATFORM Project (H2020) and supported by the PLATFORM partners listed below, is the proposer of the CWA.

Participants:

Members of PLATFORM Consortium:

Tecnalia Research & Innovation	Spain
University of Patras	Greece
Technology partners	Poland
Adamant Composites Ltd	Greece
Centro Ricerche Fiat	Italy
FIDAMC	Spain
NANOCYL	Belgium
CARBURES	Spain
SISTEPLANT	Spain
TMBK partners	Poland
ELEMENT	United Kingdom

The participation of partners from other H2020 European projects - such as Nanoreg2 - as well as members of CEN TC 352 nanotechnologies will be stimulated.

Likewise, participation in the Workshop is open to anyone, and the opportunity to participate is widely advertised in advance by its proposers and by CEN and their member bodies.

4. Workshop scope and objectives

This Workshop aims to develop a CWA to give guidance and recommendations for sustainable production of CNT-based nano-enabled products by the implementation of a Safe by Design (SbD) approach. Prevention through Design (PtD), Safe-by-Design (SbD) or Safety Integration (SI) are similar concepts that refer to design out hazards or minimize risks early in the design process.

Manufacturing is a relevant activity for achieving climate and energy policy objectives. Against a backdrop of an increasing demand for goods and increasing scarcity of resources, it is becoming more and more essential to “produce more with less”. Innovative manufacturing equipment and processes– as PPLs – should contribute to the achievement of the H2020 objectives.

Environmental sustainability is a driver for new products/markets. One of the major challenges addressed by the research priorities of the Factory of the Future is to make manufacturing environmentally sustainable, meaning that deploying manufacturing activities is decoupled from the trend of increasing the environmental footprint of manufacturing.

Around 28 % of the total energy consumption in Europe comes from industry. In highly industrialised European countries, such as Germany, this percentage rises up to 47 %. Therefore, the need of energy-efficient manufacturing processes in Europe is obvious. Reduction of resource consumption should not be limited to energy but also include water and any other material resource that does not end up in the final product, but instead ends up in the form of waste or low value added by product. Manufacturing generates about 400 million tons of waste of which 10 % are hazardous, which is twice as much as households and half of construction. Reducing waste in manufacturing will therefore contribute greatly to improving the environmental performance of the factories of the future.

In this context, the efficient and durable use of resources (energy, materials, etc.) and the reduction of emissions and waste should be key priorities in the design of the new manufacturing technologies to be deployed by PPLs, with the objective of producing more NEPs with fewer raw materials, less energy and less waste.

Thus best practices for the sustainability of CNT-based NEPs manufacturing processes will be addressed to prevent and reduce:

- consumption of energy in manufacturing activities
- consumption of water and other process materials, optimising the exploitation of materials in manufacturing processes.
- airborne emissions and waste generation by manufacturing activities, trying near-to-zero emissions in manufacturing processes

in order to achieve safe PPLs with minimum need of energy and resources and environmental impacts.

5. Workshop programme

The Workshop will embed the outputs of PLATFORM project related to best practices and guidelines for sustainable production of carbon nanotube-based nano-enabled products (CNT-based NEPs) into a CEN Workshop agreement (CWA). This will allow all stakeholders discuss and to contribute to the development of the CWA.

It is proposed to issue the CEN Workshop Agreement in February 2018. The kick-off meeting will be held as soon as possible and the estimated duration of the work is 6-7 months. During the workshop lifetime, as many meetings as necessary will be held, depending of the project evolution.

In addition to face-to-face meetings, electronic work, on-line meetings and others tools will be provided in order to facilitate the CWA drafting participation.

The CWA will be drafted and published in English.

The proposed planning to reach the CEN Workshop Agreement entails the following steps:

Activities	**Intended Dates**

Announcement of the Project plan on the CEN website	July 2017
Kick-off meeting: - Project Plan approval - CWA secretariat, CWA chairman and workshop participants approval In conjunction with Kick-off meeting the 1st workshop meeting will be held with a presentation for the first draft of the CWA	September 2017
Virtual work between face-to-face meetings (on line meetings, teleconferences, etc.) to study the comments received for registered participants	September-November 2017
Public comment phase on Draft CWA (2nd draft)	November 2017 – January 2018
2nd workshop meeting (face to face) adjusting the third draft of the CWA and final approval	January 2018
Publication CWA	February 2018

6. Workshop structure

The workshop will be operated under CEN-CENELEC rules for the CEN Workshop Agreement. A Workshop Chair will manage the workshop.

The proposed Chairman of the CEN Workshop is Mr. Jesus M.LÓPEZ DE IPIÑA, TECNALIA who will be will be approved at the Kick-off meeting by the participants.

The proposed Secretariat of the CEN Workshop is UNE. Ms. Pilar PÉREZ PARADELO as CEN Workshop Secretary.

The responsibility of the Workshop Chair include the following main activities: chair Workshop plenary meetings, ensure the Workshop develops according to the Business plan and manage the consensus building process.

Under the responsibility of the Workshop chair, the Secretariat will support the Workshop in all its activities.

The language of the CEN Workshop is English (meetings, documents, CWA…)

7. Resource requirements

The registration and participation at this CEN Workshop is free of charge. All costs related to the participation of interested parties in the Workshop's activities have to be borne by the participants themselves.

The copyright of the CWA agreement will belong to CEN.

8. Related activities, liaisons, etc.

Liasons are not foreseen in this CWA, however input from relevant CEN TC 352 “Nanotechnologies” will be highly welcomed

9. Contact points

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