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Horizon 2020 - DIRECTORATE-GENERAL FOR RESEARCH & INNOVATION
Directorate D - Key Enabling Technologies

The EU-policy on carbon composites: highlights of actual projects and future trends/plans

SEII - International Colloquium on Composite Materials

How carbon composites are revolutionizing our world !

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University Foundation, KU-LEUVEN

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Research and Innovation

The legal base

Horizon 2020 NMPB 2016 and further Council Conclusions March 2014

- *Key enabling technologies (KETs) are of crucial importance for industrial competitiveness. KETs of high industrial interest, such as batteries for electro-mobility, intelligent materials, high performance production and industrial bio-processes, should be strengthened by swiftly identifying projects of European interest. Special attention should be paid to the role of cleantech as a cross-cutting element for enhancing the competitiveness of the European industry.*

Introduction

Fibre reinforced and in particular Carbon Fibre composite materials are becoming nowadays more and more part of our lives. These composites are key elements of smart material systems and structures.

Properties such as light weight, high strength, low stiffness, smartness, their dual use and more, makes these materials more and more attractive to various industrial sectors such as transport, electronics, house appliances, construction, medicine and more, you name it.

On the other hand their recyclability constitutes a major advantage and it goes well along the main policy lines of H2020 such as e.g. circular economy, environmental protection and more.

Recycled fibres from various nature and sources are deriving from different industrial sectors and can be also used in the production of innovative SMART multifunctional materials , structures and systems.

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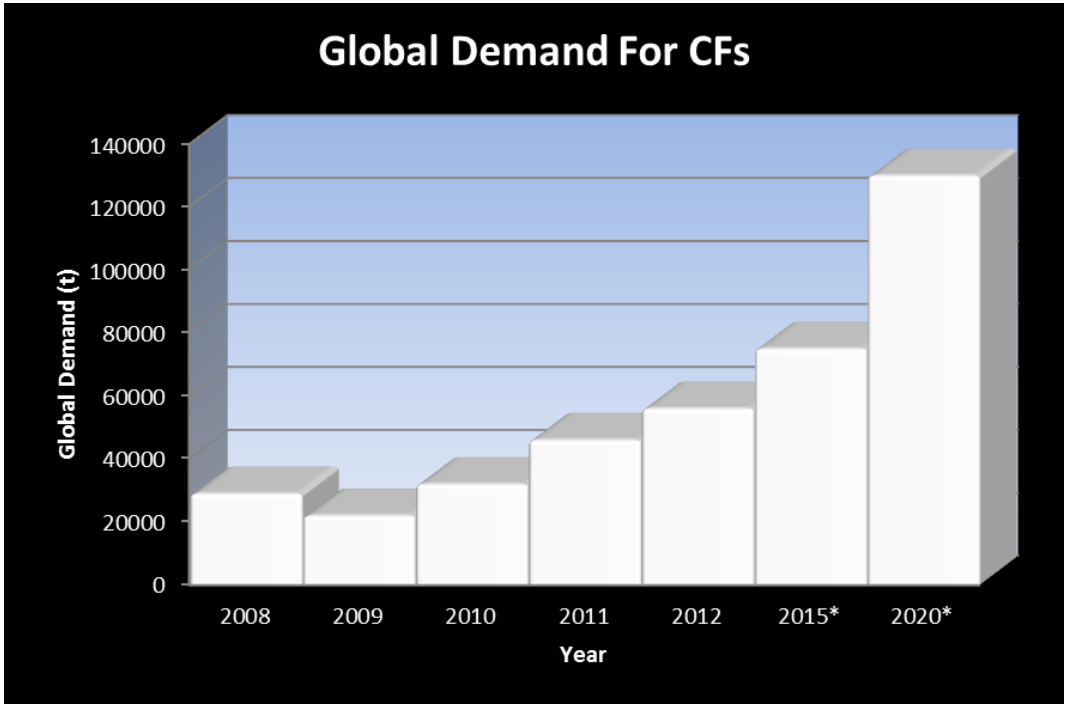
Generalities



- *Based on current price (approximately $35/kg), global market demand for CFs is expected to reach 130,000 tones ($4.5 billion in sales value) in 2020*
- *Assuming the precursor accounts for 50% of CFs manufacturing cost, precursor market is estimated to be $2.25 billion in 2020.*

✓ **CFs market is open with great potential growth**

Use of CF Composite Materials / Applications

Energy efficiency

Alternative energies

Light weight

- **General technology trends:**
  - On shore to off shore
  - Increase of rotor-blade size
  - Rotor-blades with higher strength to weight ratios
  - Integrated systems such as wind-diesel, wind-SPV, wind-battery etc.

- **General technology trends:**
  - Fuel efficient cars
  - Alternate fuels (CNG, LPG, E-10)
  - Hybrid propulsion
  - Plug in electrical vehicles

Investment in new carbon fibre capacities to follow the demand

Edison carbon filament bulb

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EU-NMP POLICY - THE PAST

1. ***Topic(s): FoF.NMP.2013-11***
   Manufacturing of highly miniaturised components
   Call for proposal: FP7-2013-NMP-ICT-FOF(RTD)
   Funding scheme: CP-TP - Collaborative Project targeted to a special group (such as SMEs)
2. ***Topic(s): NMP.2013.4.0-1***
   Graphene production technologies
   Call for proposal: FP7-NMP-2013-LARGE-7
   Funding scheme: (CP - IP) FP7-NMP-2013-LARGE-7 Large scale integrating collaborative projects
3. ***Topic(s): NMP.2013.2.1-1****.*
   Developing new precursors, new processing routes and functionalisations for carbon fibres

Call for proposal: FP7-NMP-2013-LARGE-7
Funding scheme: (CP - IP) FP7-NMP-2013-LARGE-7 Large scale Integrating Collaborative Projects

4. **Topic(s): NMP.2013.1.3-1**
   Safety in nanoscale production and products
   Call for proposal: FP7-NMP-2013-LARGE-7
   Funding scheme: (CP - IP) FP7-NMP-2013-LARGE-7 Large scale integrating collaborative projects
5. **Topic(s): NMP.2012.2.2-4**
   Cost-effective materials for larger blades for off-shore wind energy applications
6. **Topic(s): NMP-2009-2.5-1**
   Light high-performance composites
   Call for proposal: FP7-NMP-2009-LARGE-3
   Funding scheme: CP-IP - Large-scale integrating project
7. **Topic(s): FP7-SPACE-2011.2.2-02**
   Space critical technologies
   Contract type: Small or medium-scale focused research project
   Call for proposal: FP7-NMP-2012-SMALL-6
   Funding scheme: CP-FP - Small or medium-scale focused research project

NMP-2009-2.5-1 Light high-performance composites

(~ 22m€)

M-RECT	*(Multiscale reinforcementof semi-crystalline thermoplastic sheets and honeycombs)*
FIRE-RESIST	*(Developing Novel Fire-Resistant High performance composites)*
HIVOCOMP	*(Advanced materials enabling HIgh Volume road transport applications of lightweight structural COMPosite part.)*

NMP.2012.2.1-3 Self-healing materials for prolonged lifetime

(12m€)

HEALCON	*(Self-healing concrete to create durable and sustainable concrete structures)*
SHINE	*(Self healing innovative elastomers for dynamic seals, damping and noise reduction)*

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CF Cluster

NMP.2013.2.1-1 Developing new precursors, new processing routes and functionalisations for carbon fibres

(~ 24m€)

Fibralspec: *Innovative processes with streamlining and improved control will be conducted in FIBRALSPEC, through Unit for Continuous PAN-based Carbon Fiber Pilot Production. Testing of laminates and prepregs production based the new developed carbon fibres followed by manufacturing of laminates/coupons and high-performance filament wound tubes are also foreseen (equipment for delivering precise volumes the matrix (resin) in high and low capacity to impregnate the fibres and bundles will be developed).*

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CF Cluster

NMP.2013.2.1 Developing new precursors, new processing routes and functionalisations for carbon fibres

(~ 24m€)

***Newspec**:* *aims at the production of Carbon Fibres (CFs) through very promising low-cost sustainable polyethylene (PE) precursors. PE can be derived from three independent sources: bio-ethanol, synthetic oil and recycled plastics. A main attribute of this project is the use of an available pilot scale facility (HPFC) that allows design and optimization of continuous CF processing and, at a later date, easy scale up to a larger industrial size plant.*

***Carboprec**:* *The strategic objective of CARBOPREC is to develop low cost precursors from renewable materials widely available in Europe (lignin and cellulose) reinforced by carbon nanotubes (CNT) to produce high performance CF for automotive and wind energy applications.*

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EU-NMP POLICY - The Present

NMP22–2015: Fibre-based materials for non-clothing applications

3 projects (~ 24m€)

Results still to be communicated by the Commission

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EU-NMP POLICY - The Future

1. ***TOPIC : MG-1.3-2017***
   Maintaining industrial leadership in aeronautics
   Publication date: 14-10-2015
2. ***TOPIC : MG-1.5-2016-2017***
   Identification of gaps, barriers and needs in the aviation research
   Publication date: 14-10-2015
3. ***TOPIC : MG-2.2-2016***
   Development, production and use of high performance and lightweight materials for vessels and equipment
   Publication date: 14-10-2015
4. ***TOPIC : NMBP-04-2017***
   Architectured /Advanced material concepts for intelligent bulk material structures
   Publication date: 14-10-2015
5. ***TOPIC : NMBP-08-2016***
   Affordable weight reduction of high-volume vehicles and components taking into account the entire life-cycle
   Publication date: 14-10-2015

NMBP04–2017: Architectured /Advanced material concepts for intelligent bulk material structures:

Specific Challenge:

The development of smart materials has been gathering pace over the past few years to develop novel concepts for intelligent components and structures with integrated functionalities that are able to communicate and interact with their environment, store data about their condition and react accordingly to external stimuli. Research in the areas of biomimetic bio-inspired engineering and nanomaterials can provide several examples of the development of smart materials and has seen a significant expansion. Examples include materials that can alter their physical properties, (e.g. viscosity, shape, colour and more) in response to temperature, stress, electrical or magnetic fields, convert sunlight into electricity, store energy, etc. Smart materials have also been used extensively in sensor developments in aerospace and automotive applications with the aim of producing intelligent structures and components that provide information of their in-service conditions However, there are several concepts that have not yet been implemented in industrial scale. Such technologies include self-repair or self-healing materials, materials for vibration suppression, lightweight composites that can inform the user of any internal damage without the need of time consuming and expensive Non-destructive Examination (NDE), materials or structures that can undergo shape change either passively or by activation, Functionally Graded composite Materials (FGMs), energy storing components, etc. There is a need for predictive modelling of materials functionalities for those materials for which there are currently no accurate commercial or open-source codes available.

Scope:

Proposals are sought to address specific industrial needs and facilitate the implementation of smart materials for applications in transport, consumer goods and ICT. The potential extension of these applications to other industrial sectors such as e.g. oil & gas and petrochemicals will be an asset. The technical challenges to be addressed relate to the development, processing and integration of smart materials with new functionalities, as e.g. for: advanced sensors (nanosensor technologies), damage detection, self-repair, self-actuation, self-sensing morphing, magnetic functionality (for non-magnetic materials), optical functionality, sound and vibration damping, thermal management in ICT applications. Material concepts based on bio-inspired solutions can also be considered. Modelling of the properties of relevance to manufacturing should be considered and further developed. Although the materials most suited to such development are lightweight advanced composites from different material classes, (like multiferroics, polymeric, ceramic, glass or metal matrix composites, organic fibrous materials). It is expected that such smart materials may make use of the unique properties possessed by nanoparticles and therefore the development of nanomaterial based intelligent components will be within the scope of the call. The development of such material structures has to be accompanied by high resolution analytical tools that are able to simulate and characterise the materials on all scales and, moreover, to track and reveal their function –structure relations in situ. The functionalities of smart materials will require the identification of gaps in standards and future pre-normative activities will have to be addressed as part of the scope. For this topic proposals should also be able to demonstrate in addition to the development concept, the feasibility of such technologies in terms of cost, production and processing methodologies, reuse/recycling of materials at end of life and reliability. Industrial and/or additional experimental partners should ensure broad validation and adoption of both the software and the materials.

The implementation of this topic is intended to start at TRL 4 and target TRL 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

***Expected Impact**:*

The implementation of novel smart material technologies is expected to pave the way for innovative environmentally friendly smart products:

- *Enhancing the market opportunities for European industries;*
- *Improving consumer safety;*
- *Reducing maintenance costs;*
- *Improving resource efficiency;*
- *Contributing to a future circular economy;*
- *Improved understanding of materials properties based on theoretical materials models.*

Enhancing the knowledge base in the EU not only at the R&D level but also at the manufacturing and production level, creating a highly skilled workforce with improved levels of job satisfaction.

Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.

***Type of Action:** Research and Innovation action*

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Fibre Reinforced Composites IS PART OF OUR PRESENT & FUTURE LIFE!!!

THE COMMISSION CAN'T STAY AWAY !!!!

Thank you for your attention

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