

MASTRO Newsletter

Issue 1: March 2019

Message from the coordinator

We are happy to introduce you to the first newsletter of MASTRO, a European collaborative effort to develop nano-enabled bulk materials for the transportation sector. These novel materials will present self-responsive properties and will improve safety, sustainability, and comfort in transportation.

MASTRO is a 3.5 year project funded by the European Commission under the Horizon 2020 scheme that kicked off on December, 2017. This issue is providing an overview of the project objectives, its structure, the scientific efforts during the first year of operation, and our partner's communication and dissemination activities.

Welcome and enjoy!

Dr. Silvia Hernandez Rueda

Project indicators



17

Partners



6

Countries



10

Companies



7

RTDs



43

Deliverables



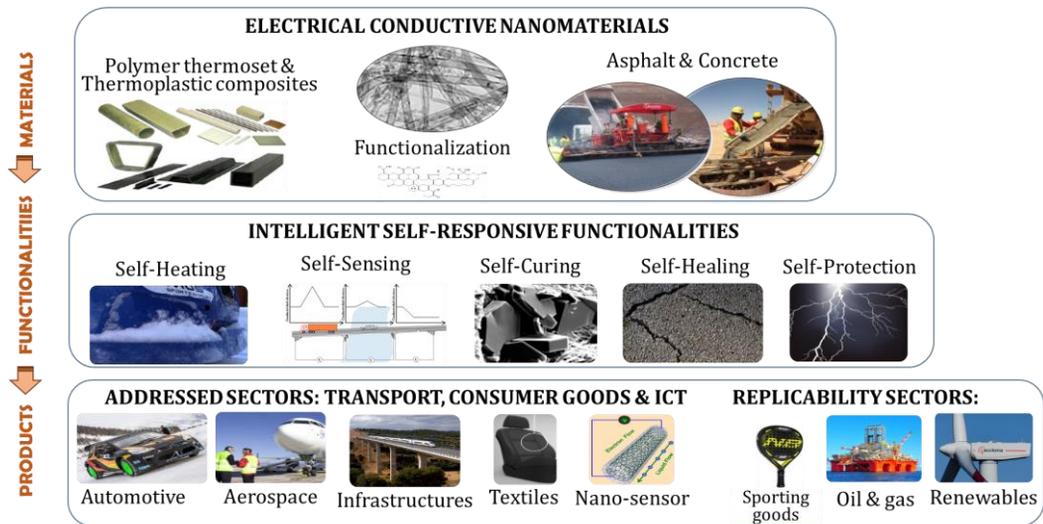
42

Months

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No. 760940. The material presented and views expressed here are the responsibility of the author(s) only. The EC takes no responsibility for any use made of the information set out.



Overview of the project



MASTRO Project overall objective is to develop intelligent bulk materials for smart applications in the transport sector incorporating several self-responsiveness properties aiming at increasing consumer safety, component life-span and performance while reducing maintenance and manufacturing costs and also through-life greenhouse gas emissions.

Efforts to fulfill the objectives are grouped in the following tasks:

1. Research activities developed at small-medium scale at laboratory environment Up-scaling of the manufacturing processes and products and model, leading to prototype testing
2. Validation of the technologies developed according to the requirements and needs defined by end-users
3. Activities focused on boosting the future market uptake of MASTRO technologies Market uptake activities will push technology commercialization and test replicability in other sectors. Research activities in materials science and

nanotechnology are complemented with computational tools in order to develop bulk materials with optimal relation between composition and self-responsive functionalities. These include the ability of the material to sense, heal, cure, protect, de-ice, and heat. Once these self-responsive materials are developed, upscaling of the manufacturing processes will take place for the production of prototypes in automotive, aerospace, and transportation infrastructure sectors. Technologies will be validated according to the needs of end-users.



Life Cycle Analysis (LCA)



Life Cycle Cost Analysis (LCC)



Standardization



Market Analysis



Business Plan

Partner updates



Acciona Construction (ACC) is responsible for the coordination of MASTRO, leads efforts for the development of smart prototype with self-responsive functionalities in transport sector, while also being active in defining specifications, design of smart materials, ICT platform, and IPR protection. In the first 12 months,

ACC established the governance structure for an effective project direction and management, provided detailed technical specifications for Transport Infrastructure validation cases and the expected performance of the smart functionalities in terms of process specifications and target requirements.



ALKE has initiated the ICT platform that enables intelligent sensing, monitoring and control of the self-responsive functionalities and focuses on covering the industrial needs from aerospace, automotive and transport infrastructure sector. Such framework is intended to include edge but also remote (cloud linked) functionalities. Proper sensor and actuator system is designed and will be strictly correlated to the type of smart materials.



APPLYNANO SOLUTIONS, S.L. has been working on the functionalization of carbon-based materials with the objective to increase compatibility with the matrices used in composites: thermosetting and thermoplastic, as well as cementitious and asphalt. At this stage, the effect of the incorporation of carbon-

based materials on different properties of the composites has been evaluated in terms of chemical, mechanical, and electrical properties.

In the next months, Applynano Solutions will participate in the scale production of carbon-based materials addressed to the pilot prototypes manufacturing.



AXIA Innovation is in charge of the innovation management in the project. In the first 12 months, AXIA has developed dissemination and communication tools, including the design, development, and updating of the project website, profiles in social media, poster presentations, and flyers. In addition, AXIA organized a training session for partners on data management, compiled an initial data management plan, and presented it to the EU NanoSafety Cluster WG-F. Finally, AXIA is researching the market environment of target sectors for the dissemination and exploitation of the project results.



BSRIA is responsible for the tasks which aim to demonstrate economic competitiveness and evaluate environmental impact of the new products in comparison with state of the art practice. In the first year of the project, BSRIA has successfully defined models of

existing products, which will be used as a benchmark for results of the MASTRO project. Additionally, BSRIA is leading the health and safety evaluation and regulatory compliance of MASTRO materials, as well as standardization and training related activities.



CETMA is in charge of the development of thermoplastic matrix smart materials. The self-responsive functionalities of interest, i.e. self-deicing based on Joule effect heating and self-protection from electrostatic discharge, will be embodied in several demonstrators for automotive and aeronautic sectors. CETMA has already preliminarily assessed the compatibility between the electrical conductive nano-materials, mainly CNTs, and the addressed matrices. The optimal parameters of the melt mixing process were defined to obtain a uniform filler distribution. For most of the produced compounds a quite good dispersion of CNTs was proved by means of SEM analysis and rheological, mechanical and electrical measurements.



citeve

TEXTILE TECHNOLOGY



During the first 12 months of the MASTRO project, the main work performed by CITEVE/CeNTI was to identify technical specifications for car seats textiles, research and select materials and additives suitable for fibre extrusion process, and support the identification of process parameters for compounding. In

addition, they conducted compounds characterization for rheological behaviour (capillary rheology, MFI) to evaluate the suitability of the developed compounds for the spinning step, electrical resistance characterization of produced compounds, and preliminary study of electronics integration and textiles structures.



DIAD Group is end user for the automotive/motorsport applications. In the first 12 months of project, DIAD led the definition of the industrial needs and the description of the use cases to be demonstrated in MASTRO, setting targets to be achieved in terms of performance, compliance to legislation, performance indicators and verification criteria to be adopted. An initial concept of the ICT platform model for these demonstrators has been defined with Alkè, Pinout and CETMA. Mastro project has been disseminated to motorsport builders at the Cesana-Sestriere race, an event of the European Mountain Climb Championship counting the participation of more than 10,000 enthusiasts and experts. In the frame of the “industrial replicability in other sectors”, DIAD Group has started to approach representatives of mining, truck, electronics and production systems sectors.



Embraer Portugal has worked on the definition and requirements for the aeronautical demonstrators, in close collaboration with AMRC, the University of Sheffield, and experts from other units of the Embraer group. This has put the different multifunctional materials in

context of potential manufacturing, operation and use, framing and directing evaluation of the development activities. Furthermore, Embraer contributed in the definition of the conceptual ICT architecture for use in the aeronautical sector.

In the first year of MASTRO project, IPC defined a methodology to carry out modelling activities for piezoresistivity and the Joule effect. This numerical workflow couples the nano- and micro-scale to allow homogenization. The first simulations calculated the percolation threshold at the nano-scale for a material with CNT. Likewise, the effective electrical conductivity can be estimated on this scale. It is important to integrate thermal effect to improve microstructure prediction. In the following months, the modelling methodology will be completed, taking into account several parameters, such as aspect ratio, distribution, cluster structure, etc.



Pinout Solutions is in charge of architecting and implementing the ICT platform of MASTRO project. Over the last 12 months, Pinout Solutions has designed and tested the first proofs of concept of this Cloud-based tool, always looking for synergies among the different industry use cases. Based on an Industry 4.0

approach, the platform will enable end-users to manage, analyze and visualize data, as well as interact with the 11 demonstrators of the project. One of the key activities of this stage has been the system integration, developing APIs and software connectors to link the end-user's technologies with Cloud standards.



Universitat d'Alacant

The University of Alicante (UA) conducted characterizations on the cement pastes for the transportation infrastructure sector. These pastes incorporate carbon based nanomaterials in an aqueous phase. In collaboration with Applynano Solutions, UA has worked on the development of stable water based suspensions testing conductivity, mechanical properties, setting time, and other properties of the resulting material.





UNIVERSITÀ DEGLI STUDI
DI SALERNO

UNISA is spearheading the design of anti/de-icing nanocomposites, with the development of a flexible lightweight heater paper, based on exfoliated graphite, and its integration in structural panels. The flexible resistive heater film/paper is characterized by a combination of unique properties with nine times faster power application compared to existing

Pad thermal systems with resistance heating employed in modern aircraft/automotive components. The feasibility of the de-icing performance was demonstrated through a series of experiments. Furthermore, UNISA is working on the physicochemical treatment of carbon nanotubes to develop the design of self-healing epoxy nanocomposites.



The
University
Of
Sheffield.

To develop the smart functionality in composites required for the aerospace sector, the AMRC studied mixing carbon nanotubes (CNT) and graphite into resin. These improved the conductivity of the composite by mixing in the nanomaterials into liquid resin at different proportions using a range of mixing conditions and different types of mixer. Samples were cast, cured and electrical resistance was measured. This showed that the percolation threshold was 0.3% and this knowledge will be applied to composites to test and develop the smart responsive capabilities in the next stage of the project.



Project News

MASTRO Physical Meetings



MASTRO Kickoff meeting at Acciona, Madrid, Spain

The Coordinator of the MASTRO project organized the kick-off meeting on 17-18 January 2018, in Madrid, Spain, where the EC's Project Officer, Dr. Achilleas Stalios (European Commission DG Research & Innovation D3) also attended the meeting.



MASTRO 6th month meeting at AMRC, Sheffield, UK

The 6th month interim project meeting of MASTRO was held on July 4 – 5, 2018 at the AMRC facilities in Sheffield, UK. Work package leaders presented the progress achieved in the first six months and outlined their plans for the following six months.



MASTRO 12th month meeting at Parque Científico of Alicante, Alicante, Spain

The 12th month project meeting was held on the 15th of January, 2018 by University of Alicante and Applynano Solutions, in Alicante, Spain. Along with progress and next steps, partners also discussed issues and actions of the exploitation, dissemination and communication plans



Project News

Events

Imaginenano 2018, Bilbao, Spain

APPLYNANO participated in the 4th edition of the largest European Event in Nanoscience & Nanotechnology, Imagine Nano that took place on the March 13-15, 2018, in Bilbao, Spain. The main objectives, challenges and goal of the MASTRO project were presented.



PYMES-MATERPLAT-PAE, Madrid, Spain

APPLYNANO gave an oral presentation on the MASTRO project during the PYMES-MATERPLAT-PAE meeting that was held in Madrid, Spain on the 10th April 2018.

Encuentro empresarial PYMEs MATERPLAT-PAE hacia el sector Transporte



APPLYNANO presenting the MASTRO project at the Imaginenano 2018 Event



PINOUT at the IoT Week in Bilbao, Spain

Annual European Rheology Conference 2018 (AERC 2018), Italy

The University of Salerno presented their work performed under the MASTRO project during the AERC 2018 conference that was held in Sorrento, Italy, on 17-20 April 2018, entitled "Functional materials for structural applications: preparation and rheological properties".

 **AERC 2018 - XV SIR**
Annual European Rheology Conference
Sorrento (Napoli), Italy, 17-20 April 2018



IoT Week Bilbao, Spain

MASTRO Project was represented by Pinout Solutions at the IoT Week 2018 conference that took place on June 4 – 7, 2018 in Bilbao, Spain. A poster was presented describing the ICT platform of the project, which will be able to create synergies between the smart materials and the IoT architecture.



IoT Week Bilbao 2018
4-7 JUNE 2018, BILBAO (SPAIN)
EUSKALDUNA CONFERENCE CENTRE

Project News

Events

9th TOP Conference, Ischia, Italy

The University of Salerno was presented at the next Times of Polymers & Composites international conference, that will take place on June 17 – 21 in Ischia, Italy. An oral presentation on the thermal degradation and fire properties of epoxy modified resins and a poster presentation on the anisotropic thermal conductivity of nano-additives and epoxy based nanocomposites, were given.



5th International Conference of Engineering Against Failure (ICEAF V) Chios island, Greece

MASTRO project will be present at the 5th International Conference of Engineering Against Failure (ICEAF V) that will take place on June 20 – 22, 2018 in Chios island, Greece. University of Salerno will present their work on “microencapsulated self – healing composites”, as well as on “covalent and non-covalent functionalization of carbon nanotubes: effect on thermal and mechanical properties of structural nanocomposites”.



7th CFPC Clustering Workshop, Chios, Greece

ACCIONA was invited to perform an oral presentation on the “Carbon Fibre & Advanced High Performance Composites (CFPC)” during the 7th CFPC Workshop, that took place in Chios island, in Greece, on the 18th June 2018.



CIMComp Hub Open Day, Nottingham, UK

USDF attended the CIMComp Hub Open Day that took place in Nottingham, UK, on the 10th of July 2018, with an oral presentation on the “Smart Composites for Aerospace Applications”. The event was held under the EPSRC Future Composites Manufacturing Research Hub.



FACTS

MASTRO attended 18 National and International Events during its first year of implementation.

NanoSafety Cluster Working Group F meeting

On 4th September 2018 an online meeting was held amongst the NanoSafety cluster WF-F were AXIA was invited to present "A Data Management Plan test case: the H2020 funded project MASTRO". The working group has the aim to act as a communication platform to discuss on databases and ontologies in the context of work performed in the NanoSafety Cluster.



XIX International Congress on Adhesion and Adhesives, Madrid – Spain

APPLYNANO was present at the XIX International Congress on Adhesion and Adhesives that took place on the 19th of September, 2018 in Madrid, Spain. The congress was organized in different thematic areas: design and simulation of adhesive joints, new techniques for characterization, durability, ageing and degradation of adhesive joints, bioadhesives, adhesion phenomena, and nanotechnology applied to adhesives. APPLYNANO presented their latest results in "Graphite-based epoxy resins: influence of the type of graphites on thermal and electrical conductivities".

8th EASN-CEAS International Workshop on Manufacturing for Growth & Innovation, Glasgow, UK

MASTRO project was present at the 8th EASN-CEAS international workshop on manufacturing for growth and innovation that took place on September 4-7, in Glasgow, UK. University of Salerno contributed with two oral presentations on the subjects of the "Dielectric properties of aeronautical nanocomposites supported by Tunneling AFM (TUNA)" and the "Multidisciplinary challenge in the design of an innovative active skin for adaptive structures". The latest research advancements of UNISA were presented to an international group of experts in materials science, manufacturing, and other disciplines related to the aerospace industry.



University of Salerno at the 8th EASN-CEAS International Workshop on Manufacturing for Growth & Innovation., in Glasgow, UK

Project News

Events

3rd International Conference of Energy in Transportation, Athens, Greece

AXIA Innovation participated in the 3rd International Conference of Energy in Transportation that took place along with the 7th International Conference of Energy in Buildings in Athens, Greece. The overall description, objectives, and scientific background of MASTRO Project was presented during the poster session. Representatives from international companies in construction, equipment, materials, etc., international research organizations, and the Hellenic Navy were present at the conference.



ChemPlastExpo 2018, Madrid, Spain

ANS has visited ChemPlastExpo in Madrid, on November 7, 2018. MASTRO project has been disseminated through the presentation of leaflets to potential end-users. Thousands of visitors have attended the international exposition, addressed to different sectors and industries, such as automobile, agriculture, construction, electricity and electronics, packaging and paintings.



EmergeMAT 2018, Bucharest, Romania

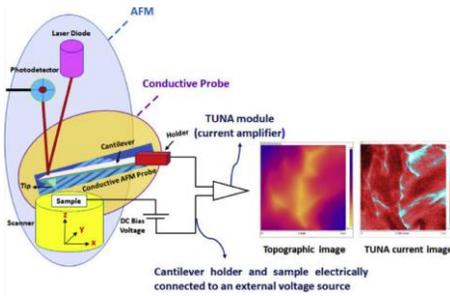
The 1st international conference on emerging technologies in materials engineering EmergeMAT and the 4th international workshop on materials under extreme conditions in the framework of the H2020 project, SUPERMAT, took place in Bucharest, Romania on November 14 – 16, 2018. APPLYNANO presented the structure of the MASTRO project and describe its goals for the development of new technologies in the transportation sector.



AXIA Innovation at the 3rd International Conference of Energy in Transportation

ANS at the ChemPlastExpo 2018, taking place in Madrid, Spain.

Electrical conductivity of carbon nanofiber reinforced resins: Potentiality of Tunneling Atomic Force Microscopy (TUNA) technique

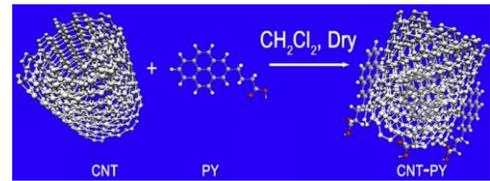


Composites Part B: Engineering
Volume 143, 15 June 2018, Pages 148-160
[DOI: 10.1016/j.compositesb.2018.02.005](https://doi.org/10.1016/j.compositesb.2018.02.005)

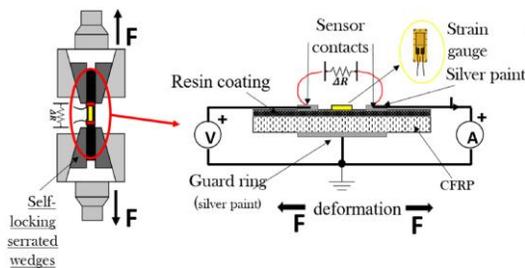
Morphological, Rheological and Electrical Properties of Composites filled with Carbon Nanotubes functionalized with 1-Pyrenebutyric acid



Composites Part B: Engineering
Volume 147, 15 August 2018, Pages 12-21
[DOI: 10.1016/j.compositesb.2018.04.036](https://doi.org/10.1016/j.compositesb.2018.04.036)



Smart coatings of epoxy based CNTs designed to meet practical expectations in aeronautics

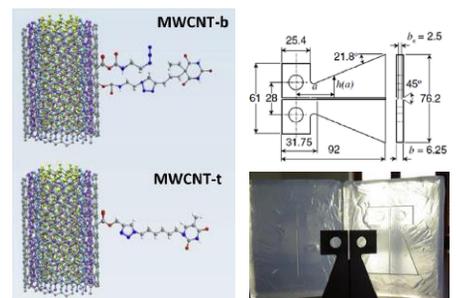


Composites Part B: Engineering
Volume 147, 15 August 2018, Pages 42-46
[DOI: 10.1016/j.compositesb.2018.04.027](https://doi.org/10.1016/j.compositesb.2018.04.027)

Self-healing epoxy nanocomposites via reversible hydrogen bonding



Composites Part B: Engineering
Volume 157, 15 January 2019, Pages 1-13
[DOI: 10.1016/j.compositesb.2018.08.082](https://doi.org/10.1016/j.compositesb.2018.08.082)



Clustering



The EU NanoSafety Cluster

(NSC) is a group of experts and stakeholders

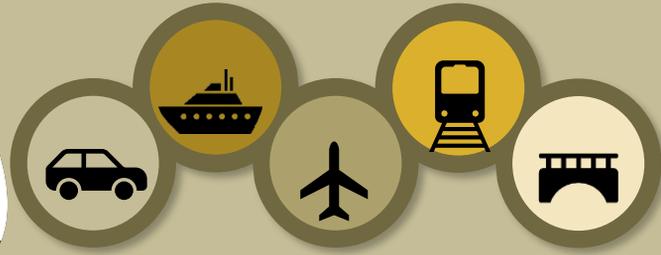
that have come together in order to facilitate collaboration for maximizing impact, policy elaboration, planning of future actions, and international cooperation. Funded by the European Commission, the NSC is coordinating several EU and national projects on various aspects of nanosafety, through dedicated working groups (WGs).

MASTRO project is participating in WG F, whose task is to harmonize and promote data management practices. In this context, AXIA that is responsible for data management in MASTRO, has [presented](#) the project's data management plan and received valuable feedback.



The EU Materials Modeling Council (EMMC) aims to enhance collaboration between stakeholders materials development, transfer platforms, and underpinning data foundations in order to establish modeling as a critical tool in creative materials design or business decision making on product innovation. Funded by the European Commission, the NSC is coordinating collaborative efforts through the involvement of experts participating in Dedicated WGs. IPC has developed the Modeling Data elements (MODA) on Joule effect modelling and has distributed it to the EMMC (<https://emmc.info/mastro-mod/>).

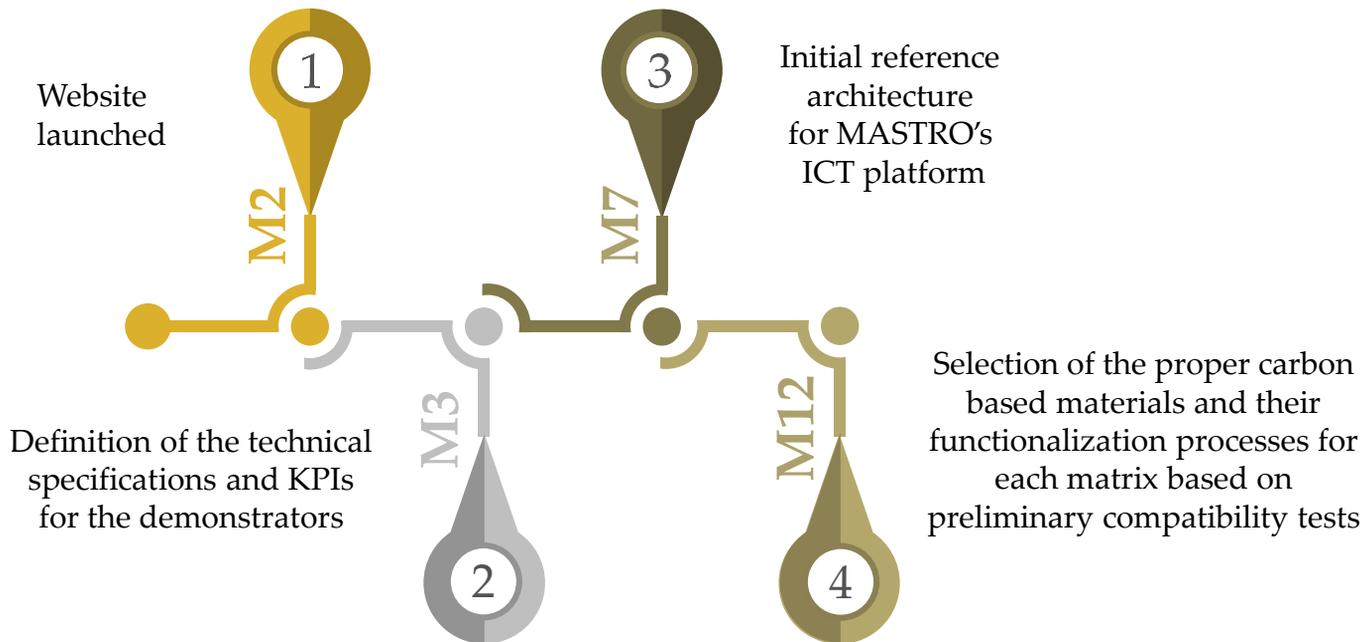
List of Deliverables & Milestones



Deliverables submitted

WP1	<ul style="list-style-type: none"> ✓ D1.1: Governance structure, communication flow and methods (M3) ✓ D1.2: Quality assurance plan (M3) ✓ D1.3: Gender action plan (M6)
WP2	<ul style="list-style-type: none"> ✓ D2.1: Report on the technical specifications for the aeronautic use cases (M3) ✓ D2.2: Report on the technical specifications for the automotive use cases (M3) ✓ D2.3: Report on the technical specifications for the transport infrastructure use cases (M3) ✓ D2.4: Report on the verification of the KPIs for the use cases (M3)
WP3	<ul style="list-style-type: none"> ✓ D3.1: Report on the production & ad-hoc functionalization of carbon nanotubes (M10) ✓ D3.2: Report on the production & ad-hoc functionalization of graphite-based material (M10) ✓ D3.3: Report on the compatibility between the carbon based materials and the addressed matrices (M12)
WP4	<ul style="list-style-type: none"> ✓ D4.1: Description of the modelling data MODA (M3) ✓ D4.2: Report on modeling strategy (M8)
WP9	<ul style="list-style-type: none"> ✓ D9.1: Project website (M3) ✓ D9.2 Data management plan (M36)

Milestones already reached



Meet the team

MASTRO consortium is a multidisciplinary mix of engineers, materials experts, and high-tech companies, from 6 European countries. For more details visit <https://www.mastro-h2020.eu/partners/>



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