

Invitation for the Expressions of Interest to join the Graphene Flagship Core 3 project

This document the application procedure for adding partners to the Graphene Flagship by Expressions of Interest (Eoi).

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1. Introduction

The Graphene Flagship's mission is to take graphene, related layered materials and hybrid systems (GRMs) from a state of raw potential to a point where they can revolutionize multiple industries. This may bring a new dimension to future technology and put Europe at the heart of the process, with a manifold return on the investment as technological innovation, economic exploitation and societal benefits.

This requires the focus of the Flagship to evolve over the years, placing more resources in areas where this transition is more likely. To accomplish this we are looking for new partners that bring in specific industrial and technology transfer competences or capabilities that complement the present consortium. The specific areas of interest and the required capabilities are listed below.

The selected new partners will be incorporated in the scientific and technological work packages of the third Core Project under the Horizon 2020 phase of the Flagship that will run during 1 April 2020 – 31 March 2023. The new partners will be requested to sign the relevant agreement with the EC – the Framework Partnership Agreement - as well as the Consortium Agreement that regulates the relations between the partners in the consortium.

The addition of new partners to the Graphene Flagship consortium is subject to the approval of the required contract amendment by the Graphene Flagship General Assembly and, at a later stage, the European Commission (EC).

Expressions of Interest must be submitted online at:

[EoI Submission Page](#)

Submission deadline is 13 June 2019, 12:01 p.m. - noon CEST (Brussels time).

2. Eligibility

In order to be eligible, an Expression of Interest must:

- Be submitted online, following the EoI submission system, and before the deadline.
- Follow the EoI application template, including all contents specified under the section “Format of Applications”
- Comply with the eligibility conditions set out in the Rules for Participation Regulation No 1290/2013, in the call Graphene FET Flagship call project included in the Horizon 2020 Work Programme 2018-2020 Future and Emerging Technologies, and in the call FETFLAG 1 – 2014 included in the Horizon 2020 Work Programme 2014-2015 Future and Emerging Technologies.

3. Format of Applications

Each EoI is limited to three A4 pages, and must describe how the organisation meets the specific competence and capability requirements in the topic(s) that it addresses.

It must include a description of the organization in general and the unit relevant to the specific call for EoIs, including name(s) and contact information of the principal investigator(s), as well as resource environment as a whole (e.g., participation in relevant national or international projects) and requested budget.

Applications should be typed in single line spacing, font Arial, pt11, page margins 2cm (top, bottom and side). Each Expression of Interest (EoI) Application is limited to three A4 pages. Figures, schemes and tables may be included within the given page limit. All references should appear at the end of the document and do not count towards the page limit.

The EoI application template is available here:

[EoI Template](#)

The application should be named as “EoIReference Organisation of the applicant” (e.g. EoIWP8-2 Company).

The application must be submitted online as a single .pdf file at the [EoI submission page](#) before **13 June 2019, 12:01 p.m. - noon CEST (Brussels time)**.

Applications submitted in a different way and/or after the deadline will not be admissible.

For administrative questions, please contact graphene-eu@esf.org, for technical questions, the contact information is given for each topic separately.

4. Selection Criteria and Evaluation

The evaluation will assess each EoI based on technological competence and impact on the specific needs in the addressed topic and how they complement the existing consortium.

A crucial requirement in the EoI is to demonstrate a genuine commitment at the highest levels towards GRM technology. This for example can be shown as a solid track record of work in the area with specific products, demonstrators or prototypes already achieved, or by the existence of a team with sufficient funding and know how, already working on GRMs. The level of funding provided by the Flagship will not be enough to create a new activity on GRMs in an environment that does not have one already. It is meant to align work already ongoing with the overall aims of the Flagship and to enable the organizations to transfer specific know how not available in the present consortium, while at the same time providing them access to the world leading competencies already present in the Flagship.

The selection will be made by the Graphene Flagship Executive Board.

5. EoI Topics Descriptions

5.1. EoI-WP2: MRAM tools developer to leverage solutions for GRM-spintronic stacks

Reference: EoI-WP2

Title: MRAM tools developer to leverage solutions for GRM-spintronic stacks

Work package: 2

Description of competences and capabilities sought:

We look for an industrial thin film vacuum deposition tools developer, specialized in MRAM stacks on 300mm scale. The company should be able to adapt its equipment and provide innovative deposition solutions to leverage GRM-spintronic co-integration issues. The primary objective is to be able to deposit MRAM stacks on GRMs, on 300mm scale, with following requirements: 1) Physical vapour deposition (PVD) growth, since this is the only industrial method for MRAM technology; 2) minimized degradation during deposition on the GRM; 3) optimization of magnetic tunnel junction properties onto the GRM, aiming at perpendicularly magnetized stacks to address industry requirements. All of the work must be carried out on 300mm compatible tools, and the optimized process will be used to integrate GRM-based spintronic technology into the IMEC FAB300 environment

Indicative budget (EC financing) for the period 1 April 2020–31 March 2023: 200 000 €

Contact persons for technical questions: Kevin Garelo, kevin.garelo@imec.be

5.2. EoI-WP4: Exposure and risk assessment of GRMs for occupational health

Reference: EoI-WP4

Title: Exposure and risk assessment of GRMs for occupational health

Work package: 4

Description of competences and capabilities sought:

We are looking for a new partner with expertise in occupational health. The aim is to study potential problems associated to occupational exposure for workers in GRM production. Assessment of the safety in the workplace is fundamental to prevent hazards. *"The health of the workers has several determinants, including risk factors at the workplace leading for example to cancers, respiratory diseases, circulatory diseases, and others"*, as stated by the World Health Organization. The new partner should focus on a) exposure assessment of airborne and suspended GRMs in the workplace; b) characterization of the physical and chemical properties of such materials; c) identification of biomarkers of exposure in workers handling as-produced and embedded (i.e., composites) GRMs. The latter work should be aligned and conducted in cooperation with the existing *in vitro* and *in vivo* activities in the Graphene Flagship. The work should be performed in close collaboration with WP15 (Production) and WP4 (Health and Environment). The new partner should have documented expertise in exposure assessment and risk assessment of nano(bio)materials for human health.

Indicative budget (EC financing) for the period 1 April 2020 – 31 March 2023: 320,000 €

Contact persons for technical questions: Maurizio Prato (prato@units.it); Alberto Bianco (a.bianco@ibmc-cnrs.unistra.fr).

5.3. EoI-WP5: Clinical translation of GRM-based therapeutic medical devices for the central nervous system

Reference: EoI-WP5

Title: Clinical translation of GRM-based therapeutic medical devices for the central nervous system

Work package: 5

Description of competences and capabilities sought:

Development of GRMs for medicine has great potential and is a rich playground for fundamental and applied sciences. In Core 3, WP5 will focus on the design of new-generation biomedical implants for the central nervous system with the intention to spatially and temporally interrogate neural circuits of interest and therapeutically intervene at specific nodal points that will provide tailored therapeutic interventions. This will provide first-line treatment options, alongside small molecules, biopharmaceuticals and vaccines, or offer synergistic benefits that will address key health care issues of non-compliance/adherence to current medical treatments.

We seek a clinical translation company with a proven track record of discovery, preclinical and clinical development, as well as marketing and authorisation of therapeutic medical devices. This industry should have a proven track record and strategic investments in the area of implanted device technologies for the treatment of human diseases. A track record of producing complex active electronic medical device implants for the central nervous system, in particular fully implantable medical devices for deep brain stimulation, is also required. The role of the new partner will be to offer guidance and leadership in the required technological, biological and regulatory steps towards clinical development of the implanted devices, with the aim of integrating GRM-based medical technologies in large scale manufacturing. The partner should have a proven track record in clinical translation of deep brain stimulation devices.

Indicative budget (EC financing) for the period 1 April 2020 – 31 March 2023: 250000 €

Contact person for technical questions: Kostas Kostarelos kostas.kostarelos@manchester.ac.uk

5.4. EoI-WP8-1: Component manufacturer for GRM-based networking devices and interconnects

Reference: EoI-WP8-1

Title: Component manufacturer for GRM-based networking devices and interconnects

Work package: 8

Description of competences and capabilities sought:

Terabit-scale densely-integrated electro-optic transceivers are needed for datacentre networks as well as 5G fronthaul links. Multiple photonic components and electronic ICs must be integrated on high-speed PCBs to demonstrate complete transceiver functionality. WP8 will develop a prototype transceiver bank consisting of high-speed GRM-based electro-optical modulators and photodetectors (PDs) integrated in a CMOS-compatible environment. Assembly of the transceiver bank on a suitable evaluation board is necessary for validating the TRL of the GRM components.

We seek an industrial partner to work with the graphene component manufacturers and design a functional transceiver evaluation board, following design practices that applied in the datacentre networking industry. The partner will supply commercial-grade ICs for interfacing with the project's PICs and will guide the design of the graphene components in order to optimize the overall transceiver design. These inputs will guide the research efforts in order to ensure that the technology is well-aligned with the high-volume optical interconnects market. A track record in design, manufacturing and supply of end-to-end intelligent interconnect solutions and IT services is mandatory, as well as a broad product portfolio in the area of optical communications with consolidated presence in the market. Potential candidates should demonstrate that their market share of components for broadband communications is prominent. Well established connections with major OEM in datacenter network infrastructure is also required. Ability to provide commercial electronic ICs for the host board needed for the validation tasks is necessary.

Indicative budget (EC financing) for the new partner for the period 1 April 2020 – 31 March 2023
€279,000

Contact persons for technical questions: Frank Koppens, frank.koppens@icfo.eu; Andrea C. Ferrari
acf26@eng.cam.ac.uk

5.5. EoI-WP8-2: : Developer of GRM-based laser systems and instrumentation for coherent Raman imaging

Reference: EoI-WP8-2

Title: Developer of GRM-based laser systems and instrumentation for coherent Raman imaging

Work package: 8

Description of competences and capabilities sought:

Coherent Raman scattering (CRS) microscopy is a label-free imaging technique allowing a user to obtain objective and quantitative information on a biomedical sample (tissue or cell culture) by measuring its molecular composition. It has proven the capability to discriminate between healthy tissue and tumour and to identify the type and grade of tumour, allowing virtual histopathology with a potentially huge impact on healthcare. The main stumbling block preventing widespread adoption of CRS microscopy in the biological and medical communities is the complication and cost of the required excitation laser system. WP8 is developing Partners a GRM-based fiber-format laser technology with the aim of reducing footprint and cost and increasing reliability of the driving laser for CRS microscopy. These fiber lasers are compact, turn-key and can be manufactured at a fraction of the cost of existing commercial solutions, removing the main obstacle to the widespread adoption of CRS technology.

We look for an industrial partner to lead the commercialization of this GRM-enabled laser technology, taking this to the growing market of medical imaging and diagnostics. A demonstrated track record in photonics, in particular ultrafast and nonlinear optics; optical microscopy, in particular nonlinear and coherent Raman microscopy; laser source development and engineering is necessary.

Indicative budget (EC financing) for the new partner for the period 1 April 2020 – 31 March 2023:
140.000€

Contact persons for technical questions: Frank Koppens, frank.koppens@icfo.eu; Andrea C.Ferrari, acf26@eng.cam.ac.uk

5.6. EoI-WP9: Manufacturing and modification of GRM-based fibres, yarns and textiles

Reference: EoI-WP9

Title: Manufacturing and modification of GRM-based fibres, yarns and textiles

Work package: 9

Description of competences and capabilities sought:

The use of GRMs in conductive textile fibres, yarns and fabrics on large-area for user-friendly, body- and head-worn wearable devices, allows integration of heating/shielding elements, conductors, antennas, large-area sensors on fibres, yarns and textiles.

We seek for an industrial partner with capabilities, know-how and facilities/equipment to manufacture yarns and textiles using different techniques from different fibres, to modify fibres, yarns and textiles and to provide scale-up requirements for industrial implementation. The partner will demonstrate elastic/stretchable electronic devices based on GRMs, focusing on applications in smart clothing, wearables, patches, as well as the integration processes for stretchable/elastic GRM-based conductors and devices to be deployed in a test environment. A track record of work in GRMs is desirable.

Indicative budget (EC financing) for the new partner for the period 1 April 2020 – 31 March 2023:
200.000€

Contact person for technical questions: Maria Smolander, Maria.Smolander@vtt.fi

5.7. EoI-WP11: Automotive company with expertise in development of fuel cells for cars.

Reference: EoI-WP11

Title: Automotive company with expertise in development of fuel cells for cars.

Work package: WP11

Description of competences and capabilities sought:

WP11 is developing novel fuel cells with GRMs present in the electrodes as well as used as anticorrosion coatings for bipolar plates.

We look for an end-user company to validate the performance of GRM-enhanced fuel cells. The applicant should be automotive company involved in the development and commercialization of fuel cell-

based cars. The company will participate to the upscaling and implementation of GRM-based components in fuel cell stacks. They will provide requirements for performance and durability of GRM-based fuel cells and validate the benefits of using GRMs in Fuel cells.

Indicative budget (EC financing) for the new partner for the period 1 April 2020 – 31 March 2023: 125000€

Contact person for technical questions: Gérard Gebel, gerard.gebel@cea.fr

Indicative budget : 125000 €

Contact person : Gérard Gebel (WPL) gerard.gebel@cea.fr

5.8. EoI-WP12: Industrial GRM-based supercapacitors manufacturer

Reference: EoI-WP12

Title: Industrial GRM-based supercapacitors manufacturer

Work package: 12

Description of competences and capabilities sought:

The aim is develop a new product line for GRM-based supercapacitors operating over an extended temperature range, exploiting spray-gun deposition of GRM suspensions on the current collector. This will include design and conception of prototypes, pre-series catalog products, including specific packaging.

We look for a company with a track record in carbon-based materials for energy, able to produce double-sided electrodes for supercapacitors combining various nanomaterials and coatings, and automatically assemble and assess their performance from prototyping to pre-series. The company should have experience in manipulating nanomaterials in safe conditions. The company will host and integrate in a dedicated and safe pilot line a roll-to-roll spray-gun deposition system build by WP12 partners and give access to WP12 partners to its measuring equipment and cell assembly line.

Indicative budget (EC financing) for the new partner for the period 1 April 2020 – 31 March 2023: 1.200.000€

Contact person for technical questions: Vittorio Pellegrini, vittorio.pellegrini@iit.it

5.9. EoI-WP13-1: : Manufacturer of GRM-based anticorrosion coatings

Reference: EoI-WP13-1

Title: Manufacturer of GRM-based anticorrosion coatings

Work package: 13

Description of competences and capabilities sought:

The integration of GRMs in protective coatings and thin films can lead to functional applications, such as antistatic layers, oxygen or water vapour barriers, as well as give improved physical and mechanical properties.

We look for an industrial partner with expertise in anticorrosion coatings of metal surfaces, to formulate functional coatings, paints, inks and varnishes for industrial applications. The applicant should have a proven track record in the production and processing of inks, paints or varnishes, as well as: 1) expertise in anticorrosion coatings, especially for metal surfaces; 2) expertise in design, compounding and formulation of composite and multi-layered coatings; 3) expertise in large scale production of coating pastes and paints, including compounding instruments such as dissolvers, high speed mixers and calendaring on lab, pilot and production scale; 4) facilities to apply paints/pastes on metal surfaces/substrates (on lab, pilot and product scale); 5) characterization and testing facilities for anticorrosion according to relevant standards (salt-spray tests, coating adhesion etc., according to ASTM and DIN); 6) track record of anticorrosion coating products and connections to end-user companies; 7) ability to take GRM-based products to the market.

Indicative budget (EC financing) for the new partner for the period 1 April 2020 – 31 March 2023:
185000€

Contact person for technical questions: Xinliang Feng, Xinliang.feng@tu-dresden.de

5.10. [EoI-WP13-2: Developer of GRM-based pressure sensors for health monitoring in automotive applications](#)

Reference: EoI-WP13-2

Title: Developer of GRM-based pressure sensors for health monitoring in automotive applications

Work package: 13

Description of competences and capabilities sought:

We look for an industrial partner with expertise in electronics for automotive and smart driving. The partner will need to integrate GRM-based pressure sensors developed in WP13 in automotive applications as Point-of-Care (PoC) diagnostics to monitor driver health in the framework of Advanced Driver Assistance Systems (ADAS). The applicant should have a proven track record in the production of radar, imaging and sensors devices as well as: 1) expertise in integration of electronic devices and sensors in automotive applications; 2) expertise in development of sensors on different substrates such as ITO/PET; 3) facilities for the characterization of pressure sensors; 4) expertise in software development for sensors; 5) track record in smart driving products, such as radars, sensor and imaging devices

Indicative budget (EC financing) for the new partner for the period 1 April 2020 – 31 March 2023:
190000€

Contact person for technical questions: Xinliang Feng, Xinliang.feng@tu-dresden.de

5.11. EoI-WP14-1: : Manufacturer to deliver a ready-to-reach-the-market sports car with enhanced functionalities based on GRM/carbon fibre reinforced polymer composites

Reference: EoI-WP14-1

Title: Manufacturer to deliver a ready-to-reach-the-market sports car with enhanced functionalities based on GRM/carbon fibre reinforced polymer composites

Work package: 14

Description of competences and capabilities sought:

We look for a high-performance car manufacturer with capabilities in design, manufacturing, and developing sports cars, and with close ties with other major automotive manufacturers. The new industrial partner will introduce GRM/CFRP composites into the car production line and establishing a value/ supply chain. Other core competencies include: design using carbon fibre composite materials, aerodynamics by means of wind tunnel and CFD, vehicle dynamics through simulations and testing, and fast and flexible production of high quality prototypes. The company must be able to produce multi-functional GRM-enhanced components in full scale car parts mounted on a prototype. The company will then need to integrate the GRM-based components into a road-ready commercial car, to promote the reliability of the concept in one product that designed for strength, stiffness and fatigue performance. It mandatory for the car to be tested and driven, while collecting feedback from sensors to validate design hypothesis and verify the structural/ multifunctional performance.

Indicative budget (EC financing) for the new partner for the period 1 April 2020 – 31 March 2023: 750000 Euros

Contact person for technical questions: Costas Galiotis, c.galiotis@iceht.forth.gr

5.12. EoI-WP14-2: GRM-based composites manufacturer

Reference: EoI-WP14-2

Title: GRM-based composites manufacturer

Work package: 14

Description of competences and capabilities sought

We look for a GRM-based composites manufacturer to support the introduction of a ready-to-reach-the-market GRM-enhanced sports car. The manufacturer will carry out the dispersion of GRMs in selected epoxy matrices and the production of carbon fibre reinforced prepregs, and the related characterization activities. In all stages of development of the GRM-enhanced sports car, the manufacturer will contribute to the development and production of GRM-containing laminates. The applicants must have a proven track record of working with the automotive industry.

The applicants must process a wide range of traditional, unidirectional and multiaxial fabrics, pre-pregs with their own formulated and manufactured epoxy, phenolic, and cyanate-ester resin systems. The applicants must have state of the art laboratories where mechanical, textile and chemical testing can be performed. The applicants must also be capable of translating WP14 requirements into a product that

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satisfies the specific needs in the most efficient and effective way. Therefore they must be capable of managing the entire manufacturing process. The applicants must have access to weaving and impregnating equipment, DSC, FTIR, TGA, DMA, Rheometry, and be able to perform measurements of resin content, gel-time, volatile content, tackiness, impregnation level, flammability. The applicants must have lab scale autoclave, press and oven cure capabilities, load test frame equipped with tensile, compression, shear and drum peel fixtures, test coupon preparation and computer data acquisition, strain gauging, laminate cross section analysis, as well as temperature, humidity conditioning capabilities. The applicants must be capable of producing a range of fibre reinforced prepregs and UD tapes that can be applied in various industries, such as automotive, aerospace, transportation. The applicant must be able to process the knowledge and capability to integrate the GRMs on thermoset polymers (epoxy resin system) at large scale and manufacture carbon pre-pregs with the right resin content.

Indicative budget (EC financing) for the new partner for the period 1 April 2020 – 31 March 2023:
90000 Euros

Contact person for technical questions: Costas Galiotis, c.galiotis@iceht.forth.gr

5.13. EoI-WP15-1: Preparation of large GRM-based multifunctional pipes by filament winding

Reference: EoI-WP15-1

Title: Preparation of large GRM-based multifunctional pipes by filament winding

Work package: 15

Description of competences and capabilities sought:

Composite pipes and tanks can be produced with a filament winding machine. These are typically made with glass-fiber reinforced with epoxy or polyester resins. WP15 is developing new GRM-containing unsaturated epoxy vinyl ester resins, with chemical and corrosion resistance, fire retardancy and electrical conductivity, with the aim to use them in burial pipes, providing sensitivity to geohazards, such as mud flow.

We look for an industrial partner to prepare pipes by filament winding of 1-3m diameter and 3-5m length pipes with GRM-containing resins. One of the pipes needs to be buried in month 24. The new partner also needs to prepare a tank with chemical, corrosion and fire retardancy and enough electrical conductivity to be used in ATEX atmosphere. The partner should have a proven industrial track record in the preparation of composites by filament winding. They must have the capability to produce large diameter pipes. The filament winder and production lines must be suitable for the production of pipes and tanks. Winders need to be operated stand-alone or in a semi-automatic or automated composite production lines, including curing. The applicant should have the equipment and facilities needed to process unsaturated epoxy vinyl ester resin with different ranges of viscosity, as well as the ability to mix catalysers and mineral fillers.

Indicative budget (EC financing) for the new partner for the period 1 April 2020 – 31 March 2023:
72000 Euros

Contact person for technical questions: Julio Gomez Cordon, julio@avanzare.es

5.14. EoI-WP15-2: Formulation of low viscosity epoxy resins incorporating GRMs for aerostructures manufactured by infusion technologies

Reference: EoI-WP15-2

Title: Formulation of low viscosity epoxy resins incorporating GRMs for aerostructures manufactured by infusion technologies

Work package: 15

Description of competences and capabilities sought:

The aeronautic industry is targeting fabrication technologies capable of fast throughput. The alternative to prepreg is to begin with a dry fibre, which must be impregnated with resin, either via vacuum bag infusion or resin transfer moulding (RTM). Epoxy resins designed for infusion have to fulfil the aeronautical industry demands. The formulation of epoxy-based resins that can be used to vacuum infuse dry fibres or preforms holds great promise for producing large, complex composite parts with <1% voids and controllable resin/fibre ratio. Vacuum infusion reduces autoclave processing costs and saves energy, as well as addressing complex parts in one shot and high production rate.

We look for an industrial partner as aeronautical resin material supplier, with a proven track record in research and development to understand how use of infusion would affect the design and manufacture of aeronautical parts. A know-how in epoxy resins formulation is required to work with GRM producers and optimize the thermoset resins in terms of rheological and physicochemical properties. A key requirement is to balance viscosity with in-service performance. Graphene can improve toughness related to impact, fracture and fatigue to help meet aerospace performance specifications. It also reduces the coefficients of thermal expansion and shrinkage, and minimizes stresses induced during cure. The applicant should optimize the wetting ability and the bond strength between epoxy matrix, carbon fibre and graphene. The number of reactive sites in the epoxy precursors controls the functionality directly acting on the cross-linking density. This, combined with the nature of the hardener agent, the functionality, the stoichiometry and the curing cycle determines the finished properties of the cured resin especially in terms of mechanical and thermal properties. The high functionality epoxy resins tetraglycidyl-4,4'-diaminodiphenyl-methane (TGDDM) and triglycidyl-p-aminophenol (TGPAP) are the main components in most aerospace grade formulations. Owing to their high reactivity and high viscosity, TGDDM and TGPAP pose difficulties when used in infusion composite manufacturing. The applicant should develop a low viscosity multi-component epoxy resin formulation suitable for an aerospace grade composite matrix. The will incorporate GRMs in order to improve properties whilst maintaining processability. The applicant will also need to develop constitutive material models through user material subroutines to model the behaviour of ice and gelatine at high velocity impact.

Indicative budget (EC financing) for the new partner for the period 1 April 2020 – 31 March 2023:
150000 Euros

Contact person for technical questions: Tamara Blanco, tamara.blanco@airbus.com