



Bu proje Avrupa Birliği ve Türkiye Cumhuriyeti
tarafından finanse edilmektedir
This project is co-funded by the European Union
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Technical Assistance for Turkey in Horizon 2020 Phase-II
EuropeAid/139098/IH/SER/TR

Focus Group Training 19

Dimitrios Papageorgiou
Istanbul, 18 July 2022

Session 2: A Detailed Look: HE CL4 Graphene Topics 2022

Graphene Flagship: 2022 Call in figures



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- Call - HORIZON-CL4-2022-DIGITAL-EMERGING-02
- 5 topics related to graphene (3 RIA; 1 IA; 1 CSA)
- Deadline: 16 November 2022
- Overall indicative budget: 43.5M€
- 8 projects to be funded (average funding: 5.4M€ per project)

Note 1: Based on Workprogramme Version Final, 22/05/2022

Note 2: Applicants should use the official call documents (including Horizon Europe Cluster 4 Workprogramme; Admissibility conditions, eligibility conditions, financial & operational capacity and exclusion, award criteria, etc. This presentation serves informative purposes.

Overview of 2022 Call Topics



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New generation of advanced electronic and photonic 2D materials-based devices, systems and sensors

RIA; start at TRL 3-4; end TRL5; 5.5M€/ project; 3 projects to be funded

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2D materials-based devices and systems for energy storage and/or harvesting (RIA)

RIA; start at TRL 3-4; end TRL5; 4.5M€; 2 projects to be funded

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2D materials-based devices and systems for biomedical applications (RIA)

RIA; start at TRL 3-4; end TRL5; 6M€; 1 project to be funded

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2D-material-based composites, coatings and foams (IA)

IA; start at TRL4-5; end TRL6-7; 9M€; 1 project

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Supporting the coordination of the Graphene Flagship projects (CSA)

CSA; 3M€; 1 project to be funded

Why is the call text so important



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- Can help to define the scope of a project
- Can define the Impact section & metrics
- Sometimes really defines the problem to be solved
- Helps to identify project gaps and potential partner roles
- Identifies potential opportunities for organisations to join consortia
- Helps to keep our project in scope
- Helps to maximise the proposal score

Turkish participation in graphene H2020 projects



- GrapheneCore1: Graphene-based disruptive technologies.

Turkish partner: SABANCI UNIVERSITESI;

<https://cordis.europa.eu/project/id/696656>

- SmartGraphene: Graphene based smart surfaces: from visible to microwave (ERC Consolidator Grant)

Turkish partner: BILKENT UNIVERSITESI VAKIF;

<https://cordis.europa.eu/project/id/682723>

- PANG: Pathogen and Graphene (Marie Curie R&I Staff Exchange - RISE)

Turkish partner: RS Arastirma Egitim Danismanlik Ilac Sanayi Ticaret Anonim Sirketi; <https://cordis.europa.eu/project/id/690836>

- GREENGRAPHENE
'Environment-Friendly and Cost-Effective Production of Graphene Nano Platelets for Composite Applications' (SME Instrument P1)

Turkish coordinator:
NANOGRAFI;

<https://cordis.europa.eu/project/id/837249>

What to consider for a graphene proposal



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- **The past:** EU funding allocated; EU funded initiatives; established R&I community;
- **The present:** EU funding allocated; Type of R&I activities to be funded;
- **Future:** 2023-2024 Workprogramme of HE CL4; What are the benefits your company/ organisation can get by entering the European graphene value chain

Cluster 4: Digital, Industry and Space

DESTINATION 4 – Digital and Emerging Technologies for Competitiveness and Fit for the Green Deal



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Contribution to KSOs of HE Strategic Plan:

- (A) Promoting an open strategic autonomy
- (C) Making Europe the first digitally led circular, climate-neutral and sustainable economy

Relevant **impact areas**:

- **Open strategic autonomy** in digital technologies and in future **emerging enabling technologies**, by strengthening European capacities in key parts of digital and future supply chains, allowing agile responses to urgent needs, and by investing in early discovery and industrial uptake of new technologies

New generation of advanced electronic and photonic 2D materials-based devices, systems and sensors (1/4)



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RIA; TRL3-4 -> TRL5; 5.5M€/ project; 3 projects to be funded

Relevance: Graphene Flagship 2D-experimental Pilot Line <https://graphene-flagship.eu/innovation/pilot-line/>



Outcome

New technological solutions with improved performance and reduced energy consumption providing significant advances towards the integration of 2D materials (2DM) technology, and the emergence of competitive value chains in graphene in Europe

New generation of advanced electronic and photonic 2D materials-based devices, systems and sensors (2/4)



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Scope

Development of 2DM-based devices and systems bringing 2DM technology:

- ✓ one step further towards the integration in current technologies and
- ✓ to the development of radically new prototypes and/or solutions for industry for a wide range of application areas
- ✓ overcoming integration costs, functionalities and/or power consumption challenges

New generation of advanced electronic and photonic 2D materials-based devices, systems and sensors (3/4)



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Scope – Devices and applications

- ✓ Develop 2DM-based electronic and photonic devices including ultrafast circuits, photodetector, and modulators, broadband detectors, switches, sensors, advanced electronics, metamaterials, etc.,
- ✓ Serving applications such as 5G and 6G data communications, wireless connections, smart machine vision, autonomous robots and vehicles, internet of things, and neuromorphic circuitry and/or imaging applications

The 2DM-based devices and systems should demonstrate their added value in terms of e.g.:

- ✓ functionality, integration, miniaturization, performances, power consumption, costs, etc.
- ✓ compared to current conventional technologies.

New generation of advanced electronic and photonic 2D materials-based devices, systems and sensors (4/4)



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Scope (continued)

- ✓ Integrate the value chain and incorporate the relevant manufacturing technologies needed to bring the developed devices towards the market and indicate how they work with the newly established Graphene Flagship 2D-Experimental Pilot Line (2D-EPL))
- ✓ Address a modelling, design, manufacturing and characterization of developed devices and systems
- ✓ Explore, develop and assess the route(s) for integration (e.g. wafer growth, transfer, wafer scale integration, co-integration) of 2DM into the devices and systems favouring industrial uptake in the longer-term.
- ✓ Include activities aiming at facilitating future exploitation of results.
- ✓ Contribution to the governance and overall coordination of the Graphene Flagship initiative

2D materials-based devices and systems for energy storage and/or harvesting (1/4)

Outcome

- Demonstrated added value of 2D materials (2DM) for energy storage devices and systems in applications where **Europe** can build competitive value chains
- New technology solutions for **portable** energy sources **outperforming** alternative technologies e.g. in terms of energy and power **density**, operational **safety**, long-term **stability**, mechanical **flexibility**, light **weight**, thin **thickness**, and low **cost** that will **enable the rapid development of** power-demanding smart devices, Internet of Thing (IoT) sensors and wearable electronics.



HORIZON-CL4-2022-DIGITAL-EMERGING-02-18

Deadline: 16 November 2022

RIA; Start: TRL3-4; End: TRL5; 9M€; 1 project to be funded



2D materials-based devices and systems for energy storage and/or harvesting (2/4)



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Scope

- ✓ Develop solutions demonstrating the potential added value of 2DM-based energy storage like large energy storage technologies, **beyond current Li-ion**, for electric power grids/solar farms/wind farms with **increased performances** in terms of durability, safety, energy density and power density
- ✓ Work on structural batteries and structural **supercapacitors** and related production techniques, i.e. energy storage devices integrated in structural parts of e.g. **airplanes or cars**, to **address the demand** of distributed sensors and electronics, functional printed micro-flexible supercapacitors for e.g. IoT applications

2D materials-based devices and systems for energy storage and/or harvesting (3/4)



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Scope (continued 1)

- ✓ (Energy harvesting) Should investigate/establish proof of concepts/develop 2DM-based devices for **energy conversion** that can **produce electricity** in response to e.g. light, moisture, flowing liquid, friction, pressure force, or heat with **unprecedented characteristics or unique functionalities**.
- ✓ Integrate the **value chain** and incorporate the relevant **manufacturing technologies needed** to bring the developed devices towards the market)

2D materials-based devices and systems for energy storage and/or harvesting (4/4)



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Scope (continued 2)

- ✓ Include activities aiming at facilitating future exploitation of results
- ✓ Demonstrate by the end of the project fully functional prototypes operating in relevant environment conditions (TRL 5)
- ✓ Cover the contribution to the governance and overall coordination of the Graphene Flagship initiative

2D materials-based devices and systems for biomedical applications (1/3)



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RIA; TRL3-4 -> TRL5; 6M€; 1 project to be funded

Relevance: Contribute to governance and overall coordination of the Graphene Flagship initiative



Outcome

New technology solutions exploiting the unique properties of 2D materials (2DM) -> reduce cost and increase the efficacy of diagnostics or therapies, OR provide new diagnostics or therapies for which there is currently no solution.

Strengthen Europe's industrial position in, early diagnostics , disease prediction and prevention, disease monitoring and reducing hospitalization time

2D materials-based devices and systems for biomedical applications (2/3)



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Scope

- ✓ Build on the **multi-functionality** allowed by 2DMs and demonstrate the advantages of combining e.g. biocompatibility, chemical stability, (bio-)sensing and actuating, and integration with flexible electronic technologies, in addition to ...
 - ✓ ... versatile surface chemistry (for interface with biology) to allow continuous health monitoring and built-in pharmacological interventions
- ✓ have a translational perspective, addressing how the devices and systems will reach the clinic, preferably led by European industry.
- ✓ Bring together **multidisciplinary teams** including engineers, material scientists, pharmacologists, biologists, clinicians, patients, and ethics experts



2D materials-based devices and systems for biomedical applications (3/3)



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Scope – Potential application areas

Application areas include:

- ✓ engineering & bioengineering of biochemical or bioelectronics diagnostics or therapeutic devices and platforms;
 - ✓ sensors for digital health;
 - ✓ electronics for brain-computer interfaces, taking advantage of flexible devices;
 - ✓ medical imaging in combination with implantable devices (e.g. MRI);
 - ✓ graphene for drug delivery of therapeutics (e.g. for neurological disorders)
- ❖ The safety aspects of the proposed technologies should be considered
 - ❖ Include activities aiming at facilitating future exploitation of results

2D-material-based composites, coatings and foams (1/3)



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HORIZON-CL4-2022-DIGITAL-EMERGING-02-20

IA; TRL4-5 -> TRL6-7; 9M€; 1 project to be funded

Relevance: Contribute to governance and overall coordination of the Graphene Flagship initiative



GRAPHENE
FLAGSHIP

Outcome

New **multifunctional recyclable** materials enabling solutions to environmental challenges

2D-material-based composites, coatings and foams (2/3)



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Scope

- ✓ 2D materials (2DM) composites, aero-gels and foams that can bring the full nanoscopic functionality of 2DM from nano- and microscale into the **macroscopic** world
- ✓ Development of 2D materials and technologies mainly addressing environmental issues including e.g.
 - ✓ energy consumption reduction in transport,
 - ✓ oil spill removal from water,
 - ✓ water purification with low energy consumption and improved water desalination
- ✓ Development of next generation, lightweight, recyclable composites and coatings endowed with key functionalities like e.g.:
 - ✓ high temperature performance,
 - ✓ structural health monitoring,
 - ✓ as enablers for, e.g., structural batteries or hydrogen storage
- ✓ Address Metal- 2DM composites enabling **ultralow friction surfaces**, reducing energy loss in sliding mechanical and electrical parts and the development of 2DM foams **enabling hydrogen economy** through catalytic hydrogen generation and storage

2D-material-based composites, coatings and foams (3/3)



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Scope (continued)

- ✓ Integrate the value chain and incorporate the relevant manufacturing technologies necessary to bring the developed devices towards the market
- ✓ (MUST) implement from the very beginning life cycle assessment (LCA) and end-of life (EOL) materials management to fully capture the advantage and develop greener materials and processes
- ✓ Include activities aiming at facilitating future exploitation of results
- ✓ Aim at demonstrating by the end of the project fully functional material systems and prototype applications operating in relevant environment conditions (minimum TRL6)

Supporting the coordination of the Graphene Flagship projects (1/3)



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CSA; 3M€; 1 project to be funded



Outcome

A strong and coherent graphene and 2D materials (2DM) initiative by providing key support functions, enabling participating projects to find synergies in their work and share best practice, and favouring interactions and synergies with national and regional initiatives, projects and infrastructures in the domain

Supporting the coordination of the Graphene Flagship projects (2/3)



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Scope

- ✓ Address the need to guarantee a sustained European leadership in 2DM, capitalise upon the investments made so far in graphene, exploit synergistically the scientific, technological and innovation outcomes of these investments and deliver benefits to the European society
- ✓ Support the coordination of the projects of the Graphene Flagship initiative that would be selected under the call topics of the initiative
- ✓ Address all the coordination and support functions necessary to build a strong Flagship initiative, including: governance, community engagement, dissemination, communication, outreach, dialogue with the public, etc.

Supporting the coordination of the Graphene Flagship projects (3/3)



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Scope - Activities

- ✓ Work on standardisation activities
- ✓ Creating new education and training curricula
- ✓ Promoting innovation
- ✓ Developing R&I roadmap activities
- ✓ Liaising with and supporting the coordination with relevant national and regional 2DM activities
- ✓ Establishing and supporting the dialogue with other international programmes and initiatives in the field
- ✓ Involve and be driven by representatives of the relevant actors of the field (e.g., academia, RTOs and industry, including SMEs)

Food for thought & Q&A SESSION

Extra topics / Funding opportunities

- ☐ EIC Pathfinder
- ☐ EIC-Transition
- ☐ HE Twinning (excellence hubs)
- ☐ ERC
- ☐ Marie Curie

CL4 Workprogramme 2023-2024 (version 01/2022)

- ☐ Pilot lines for 2D material-based devices
- ☐ Sustainable safe-by-design 2D material tech



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Other opportunities: invitations to join like this:
<https://graphene-flagship.eu/graphene/news/join-the-graphene-flagship-core-3-project>

Graphene pilot line: <https://graphene-flagship.eu/innovation/pilot-line>





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Teşekkür ederim!

Thank you!

Learn more on the Graphene Flagship activities and achievements: https://graphene-flagship.eu/media/qg0jille/graphene-flagship_annual-report-2021.pdf

Consultation report on graphene: <https://digital-strategy.ec.europa.eu/en/library/consultation-report-graphene-and-related-materials-now-available>

Horizon Europe info-days: https://ec.europa.eu/info/research-and-innovation/events/upcoming-events/horizon-europe-info-days_en

Cluster 4 info-day (12/2021): https://ec.europa.eu/info/research-and-innovation/events/upcoming-events/horizon-europe-info-days/cluster-4_en

Presentation for graphene: <https://www.youtube.com/watch?v=4NtbWbUKyhU>



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