

NEW PLANT TO MANUFACTURE GRAPHENE ELECTRONICS

EUROPEAN COMMISSION LAUNCHES ITS FIRST EXPERIMENTAL PILOT LINE FOR GRAPHENE AND LAYERED MATERIALS

By: Rebecca Waters

The European Commission will invest €20 million in the next generation of electronics and semiconductors. Graphene and related layered materials are ready to hit the market, maturing out of the lab for electronics and optoelectronics applications. The [2D Experimental Pilot Line](#) (2D-EPL) will be the first graphene foundry to integrate graphene and layered materials into semiconductor platforms, keeping Europe at the forefront of this technological revolution – and scaling-up manufacturing is a critical step forward for the advancement of electronic components.

Born within the innovative ecosystem pioneered by the Graphene Flagship EU-funded project, the new 2D-EPL will cover the entire value chain, from tool producers and chemical and material providers to manufacturing lines. This collaborative project will integrate several Graphene Flagship members to pioneer the fabrication of new prototype electronics, photonic devices and sensors integrating graphene and layered materials. The 2D-EPL will offer comprehensive prototyping services to companies, research centres and academics, so they can develop and test their innovative technologies based on 2D materials.

“By developing a European pilot line for the processing of graphene and layered materials, we aim to bring these innovative materials from the academic laboratories to the semiconductor production lines, making them compatible with the standards in the industry. Moreover, we want to offer early access to experimental pilot line production to the innovative graphene community in Europe. The pilot line will allow them to scale up the production of their innovative devices based on graphene and layered materials,” explains Cedric Huyghebaert, technical leader for the EU-funded 2D-EPL project, and programme manager for exploratory material and module integration at imec, Belgium.

Combining graphene and 2D materials with silicon could enhance the potential of electronic technologies, traditionally based on silicon. Nevertheless, integrating both materials at a large scale has been challenging, and up to now advances have progressed at a slow pace, due mostly to a lack of infrastructure. The 2D-EPL will address this challenge, allowing manufacturers to control the interfaces between silicon semiconductors and 2D materials on a large scale.



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TOOLS OF PRODUCTION

The 2D-EPL will develop the tools, chemistry and materials required for the integration of graphene and layered materials on established semiconductor platforms, which use silicon technologies. The ecosystem and procedures will be validated in state-of-the-art cleanroom environments all around Europe, such as AMO and iHP, Germany; VTT, Finland; and imec, Belgium.

In a later phase, the project will also develop modules to manufacture the basic building blocks for graphene and layered material-based technologies in the fields of optoelectronics, photonics and electronics. These modules will be publicly available for European users through multi-purpose wafers. This strategy will guarantee that these novel technologies are widely available and accessible at a reasonable cost.

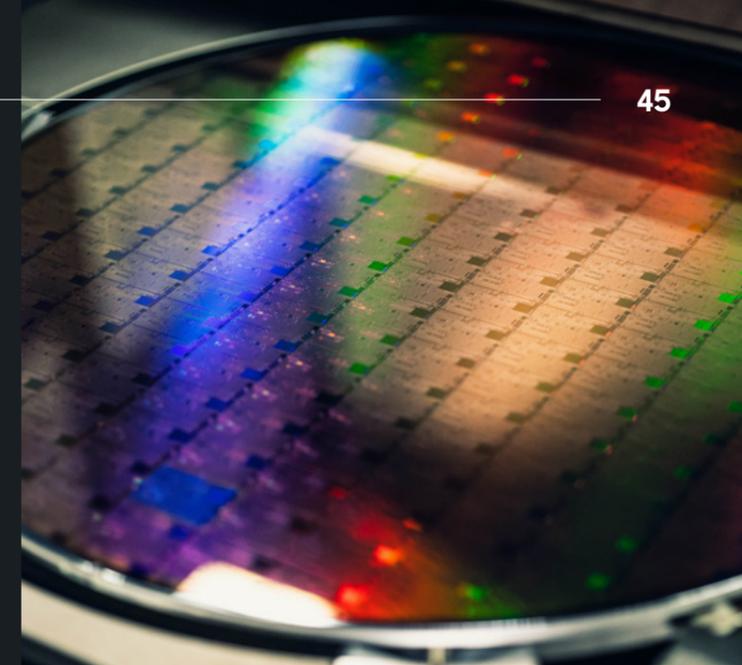
The ultimate goal of the 2D-EPL is to build demonstrators and achieve low volume production of innovative graphene and layered material-based technologies integrated with traditional semiconductors, working closely together with leading Graphene Flagship partners across Europe, including SMEs, industrial companies, research institutions and academic partners.

“For many applications, the wafer scale integration of graphene and potentially other 2D materials is required for products to appear on the market,” says Lilei Ye, the Business Developer for Electronics Applications at the Graphene Flagship. “The 2D-EPL will accelerate the manufacture of new prototypes for electronics, photonics and optoelectronics with integrated graphene and layered materials.”

THE GRAPHENE FLAGSHIP MAKES AN IMPACT

“The 2D-EPL really highlights how the European Commission, through projects like the Graphene Flagship, can make an impact in European research, development and industry,” says Graphene Flagship Director Jari Kinaret. “We identified a challenge – upscaling the production of graphene electronics – and the European Commission heard us, finding funding to address this challenge.”

A large number of partners participating in the new adventure, the 2D-EPL, are also active members of the Graphene Flagship, one of the largest research initiatives ever funded by the European Commission. The 2D-EPL will work closely with the



The 2D-EPL will produce wafers with embedded 2D materials like this one. Image: imec

Graphene Core 3 project to understand the fundamentals of graphene and layered materials and establish a plan to bring these materials to the market. The 2D-EPL will be also deeply intertwined with the Graphene Flagship industry-led [Spearhead Projects](#), leading to the production of graphene and layered material-enabled demonstrators, some of which are already being developed.

2D-EPL partners all have leading roles at the forefront of Graphene Flagship research groups. Moreover, 2D-EPL partners have also identified the need for new players to join the project to contribute expertise not yet established in the framework of the Graphene Flagship. All of these new collaborators will also join the Graphene Flagship consortium.

The collaboration between the 2D-EPL and the Graphene Flagship core projects will be paramount, as a large number of the potential applications supported by the Pilot Line are under development in the Graphene Flagship core. Nevertheless, the focus and organisation of the new 2D-EPL project is radically different – its objective is to build a long-term plan to overcome the ‘window challenge’ of publicly funded projects, and it will become a sustainable on-demand service for research and innovation in Europe and abroad.

The 2D-EPL will count on the expertise from imec, Belgium, which will lead the scientific and technological aspects of the project. The Graphene Flagship team at Chalmers University of Technology, Sweden, will also join the project – providing all its expertise in management and communication. Moreover, the pilot line will be supported by a core technical steering group consisting of principle investigators from the different partners of the project, and it will be overseen by an Industrial Advisory Board, integrated by key players from the European semiconductor industry.

The board will be constantly informed about the progress and solutions developed by the 2D-EPL project and will also provide feedback on market analysis and early opportunities for the project.