EU Graphene Flagship project aims for technological breakthroughs

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At a juncture when the economic situation has given scientists in Europe very little to smile about, the European Commission could not have better timed a new initiative that promises to deliver a healthy kick to materials research. Launched in October last year, the European Union (EU) Graphene Flagship is a 10-year, billion-euro (1.37 billion US dollars) project bringing together scientists and engineers across borders with the aim of generating technological breakthroughs around graphene and related materials.

When asked whether the purpose of the project is scientific or economic, Jari Kinaret of Chalmers University of Technology in Sweden, and head of the flagship project, said, "It really is both." The European Commission's hope is that this investment might stimulate industrial applications that have a knock-on effect on European economies, creating fresh jobs and much-needed growth.

When developing the proposal, Kinaret said, "Scientific quality was certainly the decisive factor, but the fact that we could argue for the economic impact was also important."

The flagship is one of two—the other focusing on the human brain—that demonstrate Europe's commitment to emerging areas of science that show a great deal of technological promise. Graphene is yet to realize the apparently enormous industrial potential of its unique combination of strength, hardness, lightness, and flexibility.

The project began with 75 partners from academia and industry, including the Karolinska Institute in Sweden, the Max Planck Society in Germany, and the National Physical Laboratory in the UK, along with the technology giants Nokia and Philips, and aerospace and defense firms, Airbus and Thales.

Yet despite the extent of this scientific expertise, the region has struggled to translate graphene research into technological applications when compared to the rest of the world. An analysis by the UK government's Intellectual Patent Office in 2013 showed that China, the United States, South Korea, and to a smaller extent, Japan, are the global leaders in graphene-related patents filed.

"We are less strong on the utilization," said Kinaret; "The reasons for that are not all clear. There are some fundamental problems, but that they are fundamental doesn't imply that they are insoluble." He identifies part of the difficulty to do with segmented company structures in Europe, which make it difficult for academics to link up with industry. Giant conglomerates in other countries—Samsung in South Korea, for example—have been able to recruit scientific talent to work in-house, he said.

Kinaret also adds that a large number of patents filed does not necessarily equate to commercial applications. "In recent years there has been a lot of patenting activity in China, but I'm not sure how many of those patents are exploited," he said.

Now, with the Graphene Flagship and its sizeable funding package, the European Commission's ambition seems to be to put the region in the lead. "It's a big boost for graphene research," said Andrea Ferrari, the director of the Cambridge Graphene Centre at the University of Cambridge, and chair of the project's executive board.

"The goal is to make sure that Europe exploits what Europe created," Ferrari said.

February saw the end of an open, competitive call for research proposals



Carl-Christian Buhr of the European Commission (left) congratulates Jari Kinaret, director of the Graphene Flagship, at the launch of the project.

https://doi.org/10.1557/mrs.2014.107 Published online by Cambridge University Press

in 13 areas that could bolster the engineering aspects of the project, including chemical sensors, catalysts for energy applications, and functional coatings. By the time it closed, the program had received about 215 applications, according to Nicolas Walter, senior science officer at the European Science Foundation, which has been managing the call.

"That's about what we expected. It has been successful," Walter said. The 20 to 30 winning groups are expected to join the program this autumn.

The hardest part of the flagship project is now, said Ferrari. "The biggest challenge is getting it up and running. It's not as simple as getting a billion euros in your bank account. The easy bit is for the researchers to do the research, but the problem is overcoming the bureaucratic landscape in order to create this partnership," he said.

Kinaret agrees, "The main challenge is to improve collaboration between different actors, academic and corporate. There are different traditions in, say, the chemicals industry from electronics companies."

Divided between so many countries and spread over a decade, an investment of a billion euros is less significant than it may seem. The US technology giant IBM, which has invested heavily in graphene, alone has an annual research budget of USD $6 billion. Samsung, another key player in graphene, spends more than $10 billion a year on research and development.

Even so, European nations will be hoping their bet pays off. "The fact that the flagship itself managed to get this level of funding within Europe shows there is very good expertise and potential here," said Walter.

Ferrari adds, "We don't know if the potential will be realized, but if graphene is successful, there will be a massive return on investment."

Angela Saini

USA proposes 2015 R&D budget of $135.4 billion

www.whitehouse.gov/ostp/rdbudgets

The President's fiscal year 2015 Budget proposes $135.4 billion for federal research and development (R&D) activities, an increase of $1.7 billion or 1.2% over FY 2014 enacted levels. "By continuing the Administration's record of steady support for research and development across the full spectrum of scientific and technological domains—including such diverse priorities as biomedicine, advanced manufacturing, climate science, cybersecurity, natural resource management, space exploration, and national security—the Budget ensures that the United States will be an incubator of innovation and economic growth for many years to come," said John P. Holdren, President Obama's science and technology advisor and Director of the White House Office of Science and Technology Policy.

The Budget calls for $65.9 billion for non-defense R&D, up 0.7% or $477 million from the 2014 enacted level, and $69.5 billion for defense R&D, up $1.2 billion or 1.7% from the 2014 enacted level. Basic and applied research investments total $64.7 billion, up $251 million or 0.4% from 2014. Investments in development total $68.0 billion, an increase of 2.3% over 2014.

In addition, the President's Budget proposes a separate, fully-paid-for $56 billion Opportunity, Growth, and Security Initiative that includes $5.3 billion for R&D endeavors.

Some highlights of the 2015 Budget include:

- **$12.3 billion for R&D at the Department of Energy (DOE)**, to support such priorities as clean energy and advanced manufacturing, energy security, carbon pollution reduction and climate change mitigation, and modernization of the US nuclear weapons stockpile and infrastructure—including **$5.1 billion for DOE's Office of Science**.
- **$7.3 billion for the National Science Foundation (NSF)**, the primary source of support for academic research in most non-biomedical disciplines, integrating fundamental research and education across a broad spectrum of science and engineering domains.
- **$680 million for the National Institute of Standards and Technology's (NIST)** intramural laboratories in the Department of Commerce, to support research that promotes US innovation and industrial competitiveness by advancing measurement science, standards, and technology.

The 2015 Budget also provides ongoing support for key interagency initiatives, including:

- **$1.5 billion for the National Nanotechnology Initiative (NNI)**, which supports R&D focused on materials, devices, and systems that exploit the unique physical, chemical, and biological properties that emerge in materials at the nanoscale, including Signature Initiatives in such national priority areas as sustainable nanomanufacturing, solar energy, sustainable design of nanoengineered materials, nanoinformatics and modeling, nanoscale technology for sensors, and nanoelectronics.

The 2015 Budget also supports science, technology, engineering, and mathematics (STEM) education to ensure that the US educational system is preparing students to become highly skilled workers and innovators prepared for challenging 21st-century careers. The budget proposes $2.9 billion for federal investments in STEM education, an increase of 3.7% over 2014 funding levels.

Additional details about the 2015 R&D Budget can be found on fact sheets and other resources at www.whitehouse.gov/ostp/rdbudgets. □

https://doi.org/10.1557/mrs.2014.107 Published online by Cambridge University Press