

Graphene in the heart of Europe

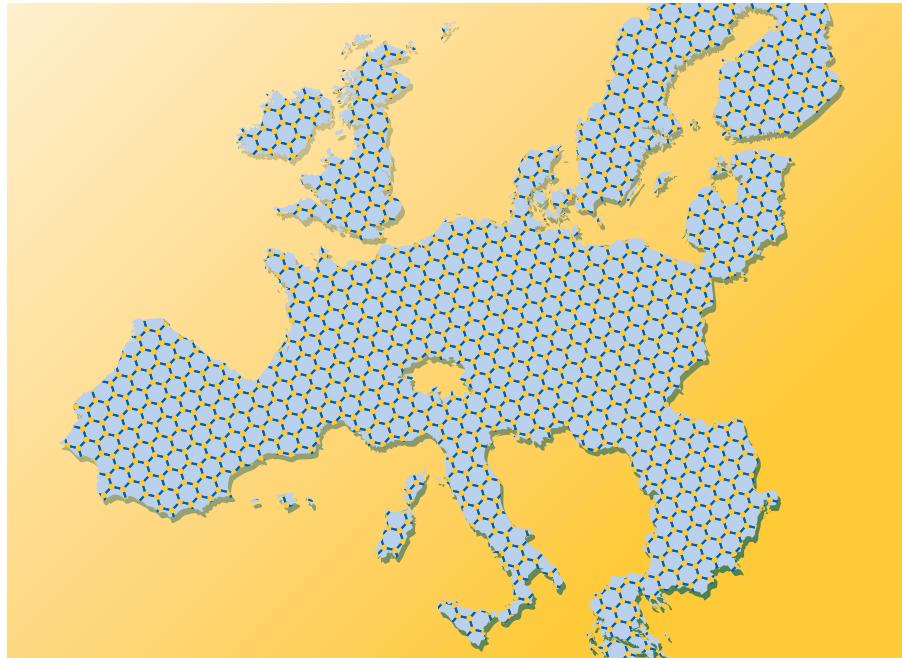
Graphene has been chosen as one of the European Commission's billion-euro flagship projects and has cemented its central position in European research.

On the 28 January 2013 the European Commission announced that a project to study graphene and another to model the human brain were the winners of their Future and Emerging Technology 'flagship' initiative. The flagship initiative aims to fund large-scale, visionary projects that involve a large platform of research institutions across Europe, and each project will be funded to the staggering tune of up to €1 billion over 10 years.

The graphene flagship is of course of particular interest to *Nature Nanotechnology*. (In this issue alone, for example, we are publishing a Review on Raman spectroscopy of graphene; page 235.) This ambitious project aims, in particular, to fund academic research on graphene and other layered materials, and transfer this knowledge to industry. The commercialization of graphene has been a topic of much focused debate since the earliest days of the field. At the conference 'Graphene: the Road to Applications', which *Nature Nanotechnology* organized with the journals *Nature* and *Nature Materials* two years ago, it emerged, for example, that priority should be given to the development of reliable techniques to synthesize large quantities of high-quality graphene. Furthermore, attention should be given to applications making use of the very high mobility, flexibility and transparency of graphene, rather than concentrating on its use in digital electronics, which, at this stage at least, is unrealistic given the absence of an intrinsic semiconductor bandgap in the material.

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These points are reflected in the graphene flagship. One of the work packages in which the project is divided will deal with the production of graphene, as well as other two-dimensional crystals and hybrid heterostructures. Different synthesis methods will be considered for different applications. For example,



chemical vapour deposition will mostly be used for flexible and transparent electronics and optoelectronics, whereas liquid-phase exfoliation will be optimized for the use of graphene-based inks. The efforts will be diversified in several areas, with, among others, work packages on high-frequency and flexible electronics, energy, and health and safety. However, the consortium will be working initially to develop applications complementary to those in which silicon is used; digital electronics is only considered realistically achievable beyond 2030.

One billion euros is undoubtedly an eye-catching amount of money, but it becomes slightly less striking when analysed in detail. The European Commission will fund half of the amount over the ten years — the remaining €500 million will come from the funding agencies of the participating countries. Of the €500 million from the European Commission, only €54 million will be available for the first stage of the project, which lasts 30 months, and in the case of the graphene flagship will be divided among more than 120 research groups. The funding will increase in the second stage, but so probably will the number of research groups involved.

It could be argued that channelling so much funding into a single field is problematic and may draw funds away from other research areas. Alternatively, given the details of the funding, it could in fact be seen as pointless, as each group will receive an amount comparable, and possibly lower, than grants provided by standard schemes. Nevertheless, the flagship programme represents an explicit endorsement of graphene by the European Commission, and is destined to generate further concentrated efforts from individual countries. The UK government has, for example, already granted several tens of millions of pounds for the development of graphene, which will be used in part to create specialized centres in Manchester and Cambridge. It is reasonable to imagine that other countries will do the same.

There is of course a risk that different European governments will, in the next few years, decide that in light of austerity measures the funding of such large focused projects is no longer warranted. But as it stands, the award ensures that graphene will continue to be a major field of research in Europe for the next decade at least. □