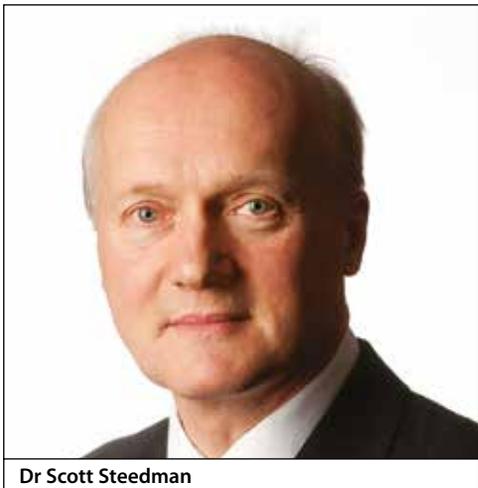


## EDITORIAL

# A CINDERELLA MATERIAL



Dr Scott Steedman

Graphene, first created in 2004 at the University of Manchester by Sir André Geim FRS and Sir Konstantin Novoselov FRS, won its founders the Nobel Prize in Physics in 2010. Hailed as a new supermaterial, the media revelled in claims that a single layer of graphene, one atom thick, would be hundreds of times stronger than a similar thickness of steel. Other extraordinary properties of graphene, which is a way of assembling carbon atoms, are just as exciting from an engineering perspective. Not only super strong, but optically transparent, highly flexible, and with high thermal and electrical conductivity, graphene could be as revolutionary a new material for engineers as the arrival of steel in the late 19th century or silicon in the 20th century.

Yet this extraordinary scientific achievement is proving slow to commercialise. Will graphene generate new manufacturing jobs in the UK or will other countries get there first?

An inquiry on graphene research and innovation in the UK by the House of Commons Science and Technology Committee has been hearing evidence from government, industry and academic experts

on whether the country could do more to turn the new science into economic growth. The National Graphene Institute at the University of Manchester, opened in 2015 at a cost of £38 million, is the leading UK centre for graphene research and development, and other universities including Oxford and Cambridge have their own centres. The UK continues to rank highly in publication and citation of scientific papers, but the exploitation of graphene at large scale in new applications remains elusive.

One argument is that UK researchers are not using the patent system effectively enough to protect new ideas. Since 2010, thousands of graphene patent applications have been filed internationally, led by South Korea, Japan, China and the US. However, intellectual property experts point out that there is no obvious correlation between number of patents and commercial success. Quality is more important than quantity, they say.

It has become clear that graphene is most likely to be used as an additive in a composite material, giving it new properties, similar to the way that carbon fibre or Kevlar is used today. Much of the development work by small- and medium-sized companies (SMEs) has focused on how to manufacture graphene and a few products incorporating graphene have begun to creep onto the market, mostly originating from East Asia.

The principal challenge is working out exactly how graphene can be used as a radical alternative solution to existing materials. A few particles of graphene in a tennis racket are unlikely to change the game of tennis. Existing materials that are cheaper and better established are likely to keep graphene out of the market until someone comes up with a compelling reason.

Hopes are pinned on a new facility, the Graphene Engineering Innovation Centre (GEIC), that will open in Manchester in 2018, and on further investment in the Centre for Process Innovation in Sedgefield, part of the High Value Manufacturing Catapult. These facilities mark a shift in UK policy towards the identification of markets and the development of products that have wide application at large scale. The GEIC is urgently needed if the UK graphene community is to demonstrate to investors that the UK is not only good at science but recognises the importance of supporting engineering companies to take new products to global markets.

More than once in the evidence presented to the Science and Technology Committee graphene inquiry, there is an implication that 'what will be will be'. Continuing to support research is essential, but this Cinderella material needs to get to the ball. The UK has a rare opportunity in graphene to stimulate new wealth creation building on its excellent science base. The first step is to bring together researchers and potential users of graphene and create a proper and sustained dialogue with industry. Only then can industry cast a realistic eye over the many ideas put forward for applications of graphene, removing those that are interesting but commercially unrealistic and focusing on those with real potential. Raising awareness across the engineering profession is critical to engaging with wider industry interests. Should this be a joint initiative for the Royal Academy of Engineering, the Royal Society and the engineering institutions?

**Dr Scott Steedman CBE FEng**  
Editor-in-Chief