
Graphene Providing a Firm Foundation for a More Sustainable Construction Industry

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If we want to achieve a zero carbon world we literally need to build it in a different way. Here, James Baker, CEO of Graphene@Manchester talks about the need to support and accelerate graphene innovation to help make building materials much more sustainable in a bid to meet regional and national net zero targets.

Greater Manchester aims to ensure all new buildings and infrastructure built in the city-region to be net zero by 2028. Innovation in new materials and processes could help build a zero carbon world from the foundations up – but this pioneering work needs to be expedited through national investment to keep pace with policy ambitions.

A recent review has suggested the addition of just 0.03% graphene powder can increase the strength of concrete by a conservative average of 25%.

A [UK](#) advanced research catalyst modelled on the [USA's Advanced Research Projects Agency](#) should adopt a 'fail fast, learn fast' series of projects to fast-track the testing of sustainable building materials.

A headline aim of Greater Manchester's ambitious policy blueprint for homes, jobs and the environment proposes all new buildings and infrastructure that are built in the city-region to be net zero for carbon emissions by 2028 – a move the local authority has said is key to achieving its overarching pledge to become a carbon-neutral region by 2038.

Under the new policy, buildings will be required to produce no operational carbon emissions. But another important consideration is to look at the opportunities to support carbon-neutral construction and encouraging 'greener' supply chains.

Innovation in new materials and processes will help planners to build a zero carbon world from the foundations up.

Graphene and 2D materials can help provide some of the technology breakthroughs needed for sustainable construction – and an obvious candidate is putting graphene in concrete. According to Chatham House, the international affairs institute, the global production of cement – the ‘glue’ that holds concrete together – accounts for a staggering 8% of the world’s CO2 production.

Interestingly, recent experiments with graphene enhanced concrete have been really promising. Adrian Nixon, editor of the [Nixene Journal](#) (an independent publication dedicated to graphene and 2D materials science news), has conducted a review of the various studies on adding tiny amounts of graphene and graphene oxide to concrete. Adrian said the addition of just 0.03% graphene powder increased the strength of concrete by a conservative average of 25%.

So, bearing in mind worldwide cement production equates to 8% of all global CO2 emissions, it could therefore be argued that by effectively reducing all concrete production by a quarter through the addition of graphene, we could in turn see this run through the supply chain and potentially deliver a 2% reduction in CO2 levels. That is an exciting proposition and one that could be debated at great length – but the essential point is this; adding a modest amount of graphene to a building material such as concrete could have a transformational impact on our environment.

And why not connect our sustainable cities of the future with a ‘graphene road’? Pioneering work with Highways England and the Graphene Engineering Innovation Centre is looking at developments to build more resilient road surfaces and motorway infrastructure that would support advances in both safety and performance. Hopefully, this will mean less potholes – but we could also feasibly have roads that one day feature embedded technologies that are more receptive to the next generation of electric cars and vehicles.

Another example of graphene-based sustainability is at the other end of the product lifecycle and how to better reclaim materials from redundant structures and unwanted fittings. My colleague Dr Vivek Koncherry from [Graphene@Manchester](#) has a proven method of adding tiny amounts of graphene to discarded tyres that once chopped up and reformed can produce a recycled product that has the performance that almost matches brand new rubber. What if we applied a similar method to re-purpose old building materials so we can build something brand new?

The disruptive role of graphene and 2D materials in sustainable construction is very exciting and works across the sector – but we need to rapidly accelerate the innovation if we are to realistically hit any of our targets. I would ask decision-makers act in number of ways:

National:

Grand challenge for building: I have previously welcomed [UK](#) government plans for an advanced research catalyst modelled on America's Advanced Research Projects Agency (ARPA). I would recommend that a nationally-funded programme of 'fail fast, learn fast' development projects are commissioned and funded by this type of body to fast-track the testing of sustainable building materials. This work could be expedited by delegating across the [UK](#) with, for example, regional expertise at The University of Manchester leading on graphene enhanced products. This grand challenge approach is similar to the [UK's](#) national Faraday battery challenge that is looking to transform energy storage technologies.

Regional:

'Lighthouse' projects: with innovation delegated to regional centres of excellence, it would be ideal if local authorities looked to support exemplar build projects that are made wholly or partly from sustainable materials. These would act as 'lighthouse' projects and provide a full-scale demonstrators on real world application of new building technology. For example, Greater Manchester could look to build a stretch of road featuring a graphene-enhanced surface or commission a public building or bridge that is made, or partly made, using graphene concrete for example.

Green procurement: local authorities could consider introducing planning recommendations at the bidding/competition stage to proactively attract contractors who are willing to use new and sustainable building materials within their development projects.

Read the [original article](#) on Manchester Policy Blogs.