GRAPHENE ENHANCED CONCRETE

AN EVALUATION OF ACTOR NETWORK THEORY AND THE EFFECT OF GOVERNMENT POLICY IN A UK CASE STUDY

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By

Erika Heupel

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SOCIOTECHNICAL SYNTHESIS

Cement, the key ingredient of concrete, is the most used material on the planet after water. However, its production is responsible for 8% of global annual carbon dioxide emissions. For this reason, the technical project examines graphene nanoplatelets (GNPs) as a potential solution for lessening the amount of cement needed in concrete. Research indicates that graphene in concrete requires less cement while maintaining the same building loads, leading to better durability, mechanical strengths, and sustainability. The science, technology and society (STS) topic will examine the construction industry and its actors working to negate the carbon dioxide effects of increased construction. This framework will be viewed through the lens of Actor Network Theory (ANT) developed by Bruno Latour, Michel Callon and John Law. Overall, unless new sustainable measures are implemented, the public cannot rebuild, without adding to the climate change problem. As government policies and building actors focus on low-carbon construction, engineers must be ready to develop green solutions.

To keep up with construction demands, the technical research paper seeks to understand methods in which graphene-reinforced concrete can be best fabricated for peak performance. A variable that must be analyzed to determine its effect on concrete strength properties, is the method and dispersion time of graphene particles in an aqueous solution. Thus, the effect of sonication duration time on solution dispersion and graphene flake particle size was investigated; with the goal of finding the lowest time that would yield the best dispersion results.

Two GNP types: C300 and M25 were used during experimentation; both had significant reductions in particle size and increases in dispersion up to a sonication duration of 60 minutes. However, the smaller size of the C300 particles provided better dispersion results. Though it was

theorized that smaller particles could be critical in improving cement strength capabilities, this trend was not shown during compression testing.

Within the construction industry, innovations require the mobilization of multiple resources and actors. However, policy must be enacted to offer far reaching *sustainable* innovations. The STS research evaluated the ability of government sustainability policy to foster the implementation of low carbon technologies in the construction industry, and the necessary actors involved to achieve. This topic explores an actor network analysis of the industry, a case study of a UK construction project and its government's recent net zero policy.

The findings from the case study and UK's net zero strategy suggest that with government partnership, actors in construction are able to become leaders of sustainable innovation and expand their green portfolios. Though national policy does not openly create innovations, it sets up economic frames like funding, which makes a sustainable agenda attainable. So as a result, firms, investors, and researchers can be more ambitious with green technological development.

If graphene-reinforced concrete can be consistently fabricated with improved properties like strength and durability, then it has the potential to revolutionize the construction industry and push for environmental preservation. Although there are a multitude of interactions needed to construct a green and sustainable construction sector, with directives or funding from the government, construction enterprises can be compelled to be more environmentally responsible as an entire industry.

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