Application Internship EPSRC-facing project

Project Title: Exploring graphene-reinforced rubber for vibration reduction
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Department: Engineering

Project Proposal

The incorporation of graphene into polymers, a process known as reinforcement, has been shown to significantly enhance many of their mechanical properties. This includes improvements in tensile strength, elasticity, and durability. These reinforced polymers, therefore, present a promising avenue for a multitude of applications. Concurrently, there is a growing need for effective vibration solutions, particularly in the context of the rapidly expanding railway systems. The environmental noise produced by these railways is a significant concern, and mitigating this through innovative vibration solutions could greatly reduce noise pollution, contributing to a more sustainable and less disruptive expansion of our transportation infrastructure.

This project aims to advance the understanding of an innovative engineered material designed for vibration reduction. This material is constructed by layering recycled rubber pads, each coated with a super-thin film of graphene nanoplatelets (GNP) [1, 2]. The aspiration is that this newly engineered material will possess the capability to absorb and dissipate the energy from mechanical waves that would typically emanate from vibrating sources like moving vehicles or machinery.

The internship will involve utilising the cutting-edge facilities at the University of Exeter (UoE) to deposit graphene on recycled rubber pads and other substrates, such as fibres. The subsequent phase of the project will focus on the fabrication of a variety of elastomeric bearing prototypes, using a hot-press machine to cure the specimens. The intern's primary objective will be to investigate how changes in material properties and geometry affect the compound's behaviour under different dynamic loads, such as shear and compression. This will be accomplished by employing dynamic testing equipment to gather and analyse experimental data from the produced prototypes, with the aim of identifying conditions conducive to the production of low-carbon, economically viable isolation bearings.

The internship will span a period of 8 weeks, structured as follows:
Week 1: Desk-based activities including background reading, risk assessments, and lab inductions.
Week 2-4: Lab-based work involving training on the use of spray coating and prototyping.
Week 5-6: Lab-based work focusing on training with testing machines and data collection.
Week 7: A combination of desk and lab-based work for data analysis.
Week 8: Dedicated to report writing.

References:
[1] Rivera ED, Londoño Monsalve J, Craciun MF, Marsico MR. (2023) Experimental Assessment of the Mechanical Performance of Graphene Nanoplatelets Coated Polymers, Advanced Engineering Materials, volume 25, no. 23, DOI:10.1002/adem.202300830.

[2] Marsico MR, Londoño Monsalve JM, Shin D-W, Craciun MF. (2020) Graphene–Rubber Layered Functional Composites for Seismic Isolation of Structures, Advanced Engineering Materials, volume 22, no. 7, DOI:10.1002/adem.201900852.