Graphene Nanoplatelets (GNPs) Enhanced Water-based Elastomer Nanocomposites – tailored production from Nanoscale to Macrostructures

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Elastomers of water-based (WBE) origin are generally of low mechanical and thermal properties. Hence, need for improvement of their properties. Graphene based nanomaterials are currently being employed as fillers for polymer reinforcements (1, 2, 3), majorly due to their exceptional mechanical, thermal and electrical properties. However, utilising graphene materials such as graphene nanoplatelets (GNPs) for WBE reinforcement comes with a huge challenge of agglomeration which could lead to poor filler-matrix interface due to inefficient dispersion. In this work, we present novel production techniques tailored towards the efficient manufacture of GNP water-based polyurethane (wPU) nanocomposites, without the introduction of solvents. Our result shows a strong improvement in mechanical properties (such as elastic modulus, tear strength and ultimate tensile strength with a significant gain in elongation at break) of the wPU upon GNPs addition. This infers that GNPs are strong graphene candidates for the enhancement of WBEs such as wPU. The GNP-wPU nanocomposites were characterised by employing techniques such as Infrared spectroscopy (FTIR), X-ray diffraction (XRD), and Raman spectroscopy, as well as optical and scanning electron microscopy (SEM). The produced GNP-wPU nanocomposites have strong potential for application in industrial sectors such as aerospace, automotive, healthcare, maritime, technical textile, and sports industries.

References

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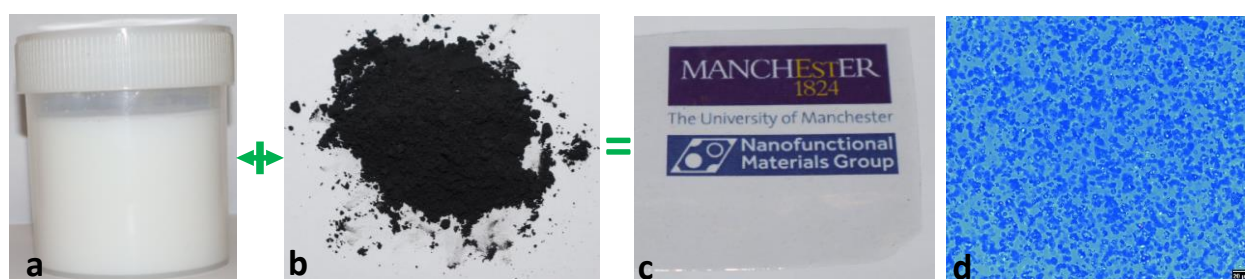
Figures

Figure 1: Digital image of (a) neat water-based polyurethane (wPU) dispersion (b) neat graphene nanoplatelets (GNPs) powder (c) 0.05 wt% GNP-wPU nanocomposite film (on-top covering our group logo, highlighting transparency of the composites), and (d) Optical micrograph of 1 wt% GNP-wPU nanocomposite (Scale bar: 20 μm).