# Thermo-Mechanical Evaluation of Graphene Enhanced Elastomer Nanocomposites for Industrial Applications

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Graphene exhibits exceptional mechanical and thermal properties, including an elastic modulus of approximately 1 TPa, making it highly suitable for reinforcing polymeric materials. Elastomer formulations, particularly waterborne systems such as polyurethane dispersions continue to attract significant attention from industry and academia for advanced applications. This work examines improvements in the mechanical and thermal properties of polyurethane elastomers achieved through graphene reinforcement and the incorporation of a chemical crosslinker. Static and dynamic mechanical analyses, together with non-destructive characterisation techniques including Raman spectroscopy and X-ray diffraction (XRD), were employed to evaluate the graphene-enhanced elastomeric materials. The findings indicate substantial increases in static tensile modulus and dynamic modulus, with corresponding enhancements in strength, elongation, and tear resistance, as well as improved thermal stability attributable to graphene integration. Collectively, these results suggest strong potential for graphene-enhanced polyurethane elastomer nanocomposites in advanced industrial applications across sectors including coatings, robotics, textiles, aerospace, and automotive.

References

[1] Nwosu et al., Composites Part B: Engineering, 308 (2026) 112954
[2] Nwosu et al., Nanoscale, 13 (2021) 9505-9540

Figures

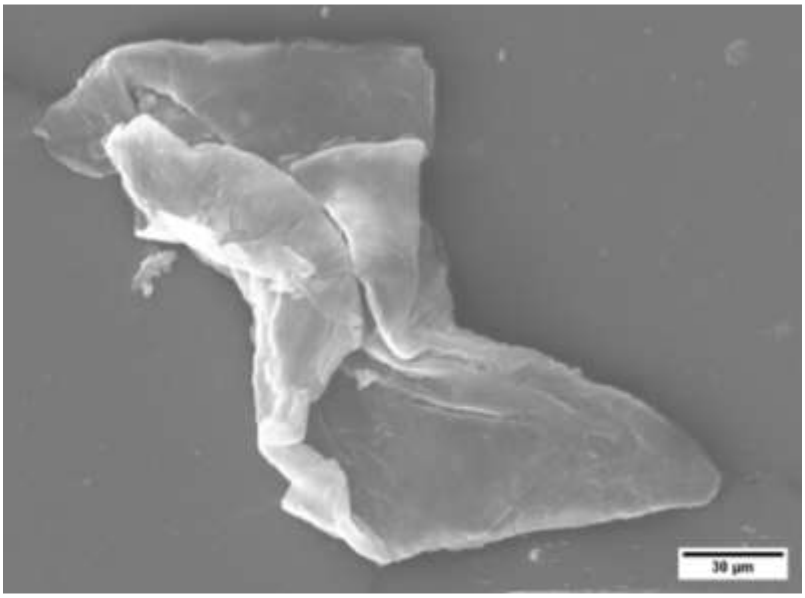


**Figure 1:** Graphene sheet encapsulated in an elastomeric blanket (Scale bar: 30 μm