
Multifunctional Composites Enabled by 2D Materials

Ian Kinloch

Dept of Materials, National Graphene Institute and Henry Royce Institute, University of Manchester, Manchester, UK,
ian.kinloch@manchester.ac.uk

Graphene-related materials possess a unique combination of properties that make them highly effective reinforcements in composite systems, particularly when integrated into hybrid architectures alongside other fillers.

Our work will begin with an investigation of percolated network formation using a combination of experimental characterisation and Monte Carlo simulations. These fundamental insights will then be extended to hybrid systems to study the interactions among carbon nanotubes, graphene, and carbon black during network development. Building on this understanding, we will explore several application areas for conductive composites, including graded insulators for high-voltage power transmission, out-of-autoclave repair of carbon-fibre composites, non-destructive terahertz imaging, and structural health monitoring.

We will also examine how the exceptional barrier performance of graphene can enhance ultra-high-molecular-weight polyethylene (UHMWPE) as a sealing material, with the long-term goal of providing an alternative to PFAS-derived fluoropolymers. Finally, we will assess the resilience of these materials and structures to multiple recycling cycles to evaluate their suitability for circular-economy manufacturing.
