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Innovation of graphene fibre composite processing using pressurised gyration

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A simple and effective process combining pressure and gyration has been developed to produce graphene-nanoplatelets-fibres composites using thermoplastic polyurethane (TPU) and phenolic resin (PR) polymers. Processing parameters such as rotation speed, pressure and polymer concentration had a marked influence on the fibre diameter. Morphological, rheological, physico-chemical and thermal properties of the composite fibres were evaluated to uncover possible application areas of these products. The aim of the work is to develop a novel processing route to generate well dispersed polymer-graphene composite fibres which could be used in fuel cells and in electronic packaging. The pressurised gyration processing conditions, such as vessel rotating speed, working pressure and the polymer concentration used, had a significant effect on fibre diameter. FTIR and Raman spectroscopy analysis confirmed the various bonding characteristics of the hybrid composite fibre structures. Focussed ion beam milling and etching verified the effective incorporation of graphene nano platelets into the fibre composites. The well dispersed and strongly adhered graphene in the polymer matrices will contribute to a unique reinforced polymer composite for many applications. Importantly, the approach is a promising large-scale manufacturing route for producing graphene reinforced composite fibres at low cost that has been developed here.

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