Damage tolerance through targeted delivery of 2Dmaterials in structural composites

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Abstract
The inherently limited fracture toughness of carbon fibre-reinforced composites is a critical challenge, particularly for those manufactured via out-of-autoclave (OoA) processes. Reduced resistance to crack initiation and growth often leads to delamination and premature failure, limiting the reliability and structural performance of composites. Improving fracture toughness is therefore essential to enhance the damage tolerance, durability, and service life of these lightweight materials, ensuring they can meet the demanding requirements of aerospace, automotive, and renewable energy sectors. Traditional approaches with thermoplastic veils as interleaves offer some improvements especially in mode I fracture toughness but at the cost of increased laminate thickness and significant manufacturing complexity. This presentation reports the development of novel fracture toughness strategies involving GNPs delivered through a dissolvable polymer system integrated with dry preforms. Uniform dispersion of GNP has resulted in highest mode II fracture toughness values reported in literature.

References

[1] Quan et.al. Interlaminar fracture toughness of aerospace grade carbon fibre reinforced plastics interleaved with thermoplastic veils, Composites Part A, 128(2020) 105642

Figures

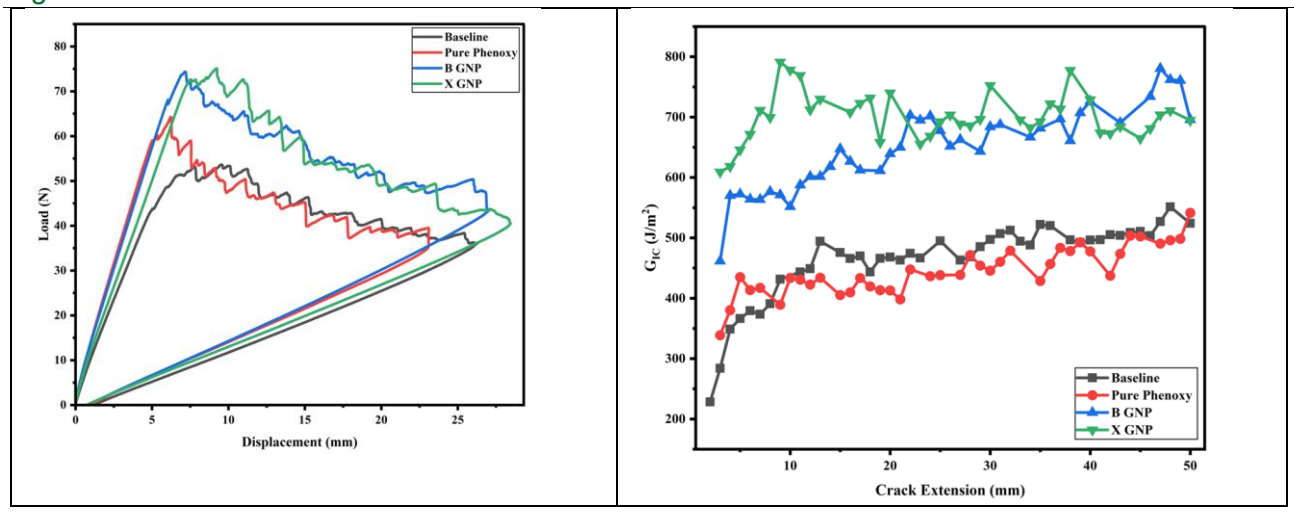

Figure 1: Improvement of mode I fracture toughness with GNPs

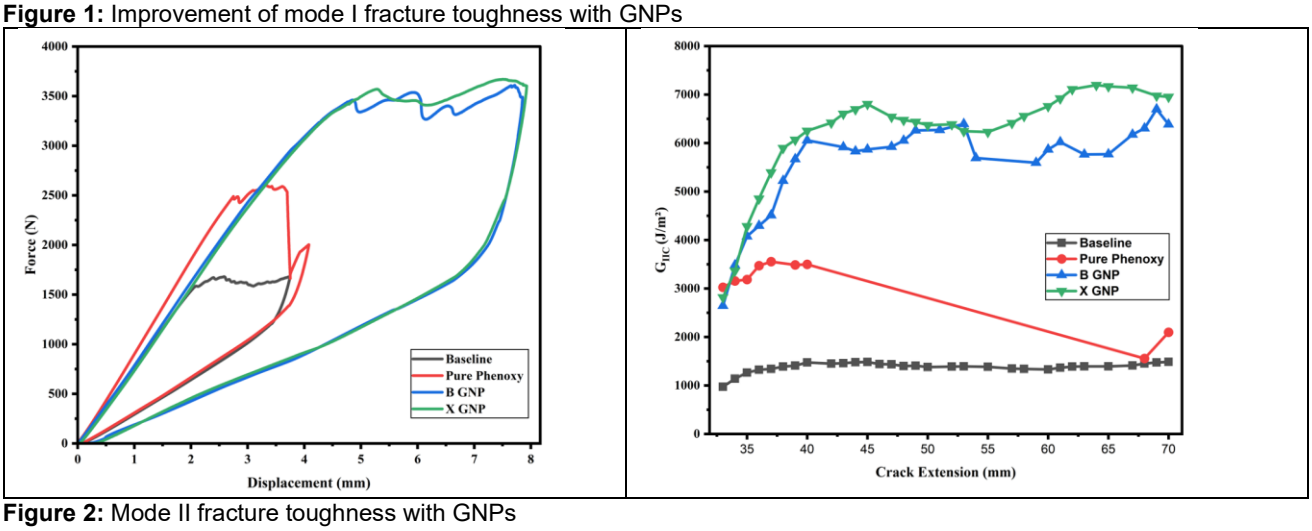

Figure 2: Mode II fracture toughness with GNPs