

HiPerDuCT Programme Grant

Final report: Discontinuous Prepreg

Discontinuous Prepregs with Interleaves

The failure modes of fibre reinforced composites can be altered through the introduction of discontinuities in the fibres or through the inclusion of interleaved materials between the laminae. When prepreg plies are cut to produce a discontinuous architecture, the tensile properties of the resulting composites are strongly dependent on the overlap [1,2, 3] and the materials contained within the interply region. The insertion of tough thermoplastic interleaves in a unidirectional carbon fibre reinforced composite is expected to improve shear properties in tension in matrix dominated failures/configurations [4, 5]. The combination of a discontinuous composite architecture with an interleave region was explored.

A pre-cut unidirectional carbon fibre prepreg composite, with an overlapped finger-joint architecture, was produced with polyethersulfone (PES) interleaves, Figure 1 [6, 7]. When the tough thermoplastic interleaves spanned only the central portion of the overlap, a crack arresting failure mechanism was observed in tension. A pronounced plateau region or pseudo-ductile response was shown in conjunction with a strain hardening response after crack arrest (Figure 2). The local strain-to-failure of PES interleaved samples was increased by 85% compared to the pre-cut baseline. The interleaving process is simple to implement and can be used without changing the prepreg curing cycle. Further developments, for example, multiple overlaps for an increased strain-to-failure or the use of alternative interleave materials, could be exploited to yield a high performance yet (pseudo-)ductile composite response under tension.

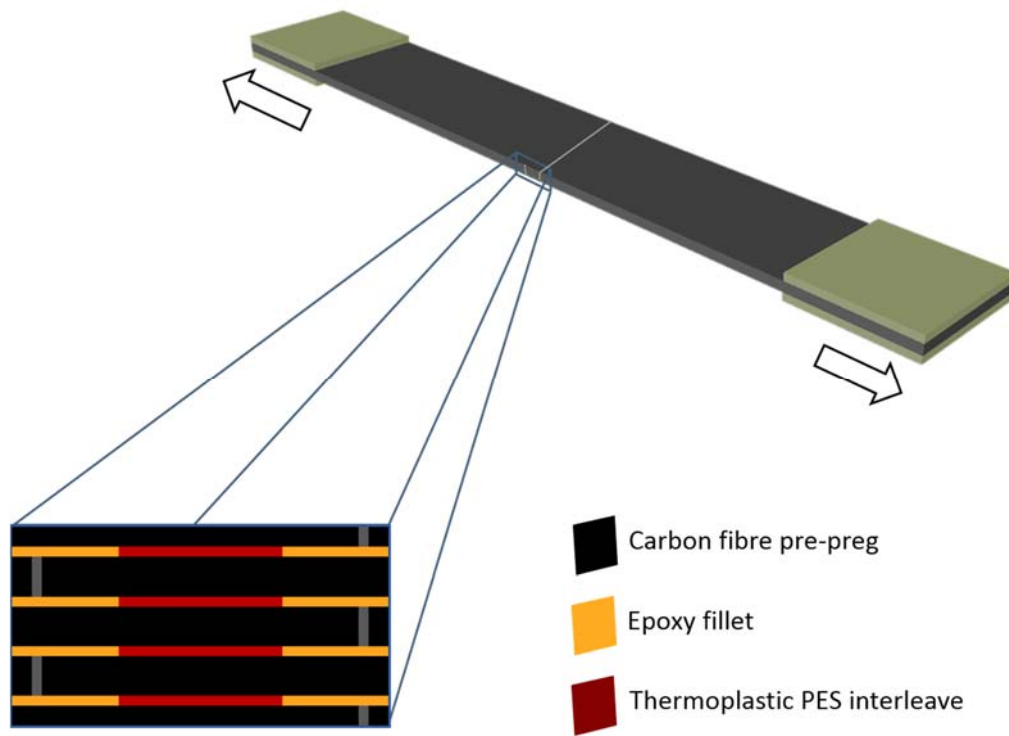


Figure 1. Discontinuous composite architecture with a thermoplastic toughened interleave region with epoxy fillets.

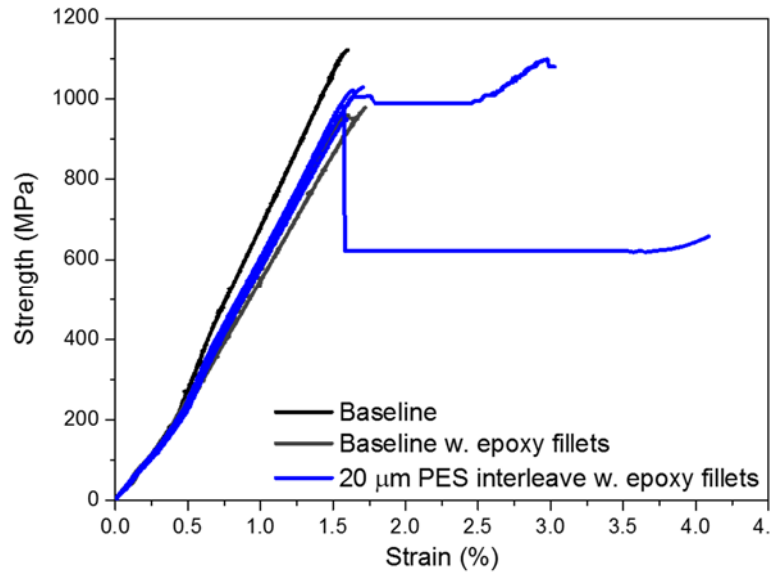


Figure 2. Tensile tests of discontinuous unidirectional carbon fibre PES interleaved composites with a comparison baseline of discontinuous unidirectional carbon fibre composites with and without epoxy fillets.

References

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