

HiPerDuCT Programme Grant

Final report: Optimised Matrices

Compression

To inhibit shear instability of the fibres in a composite in compression, polybenzimidazole (PBI) was examined as a composite matrix, given its high modulus (5.9 GPa). Several processing methods were explored (solution processing and heat pressing proved difficult to mill using both jet- or cryo-milling) [1]. Ionic liquids were employed as a greener alternative to conventional solvents as 1-ethyl-3-methylimidazolium acetate has been reported in this context. PBI was dissolved successfully and cast on (sized-removed) bi-directional carbon fibre plies. A specimen was fabricated and tensile tested as 1 ply composite to demonstrate fibre-matrix consolidation. The elastic modulus was measured as (33.99 ± 3.51) GPa.

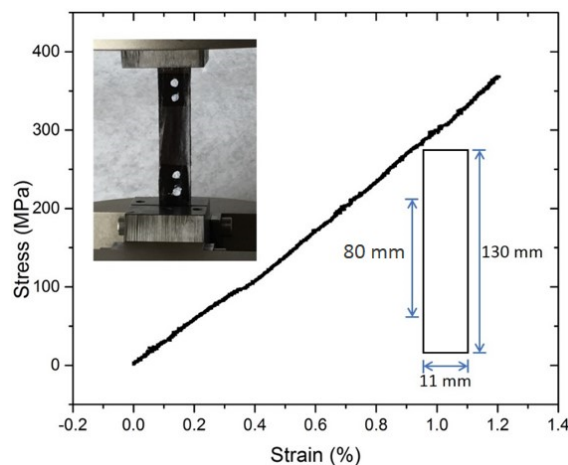


Figure 1: Tensile test of a single ply of PBI-carbon fibre composite, fabricated using an ionic liquid.

Using the electrospinning rig at the University of Surrey, PBI nanofibres were successfully fabricated. This was of interest as the fabrication of nanofibres allows easy and complete removal of solvent without further treatment (vacuum oven etc.). In addition, the nanofibres can be cast straight on to the CF ply.

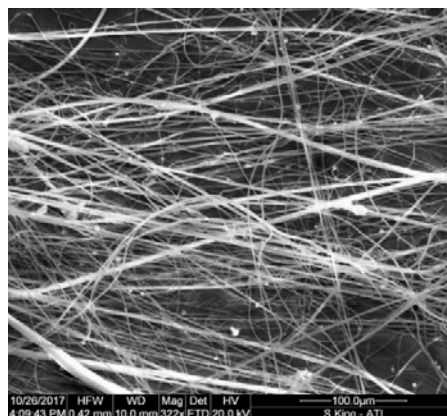


Figure 2: SEM image of the PBI nanofibres.

References

[1] T. R Pozegic and I. Hamerton, "Polybenzimidazole Carbon Fibre Composite – Utilising a High Performance Thermoplastic," 21st International Conference on Composite Materials (ICCM). 2017.