



Microstructural strain localisation phenomena in fibre-reinforced polymer composites: Insights from nanoscale digital image correlation and finite element modelling

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ABSTRACT

Multiscale models for fibre-reinforced polymer composites currently lack experimentally validated microscale damage descriptors as input parameters. This work demonstrates the occurrence of strain localisation phenomena at the fibre/matrix level using nanoscale digital image correlation. Unidirectional carbon-fibre reinforced epoxy and glass-fibre reinforced PMMA composites were loaded in transverse compression in a scanning electron microscope. Radial and shear strain maps were extracted and compared with finite element simulations based on a conventional elastoplastic model. Near the interface, an interphase layer is present in the matrix, presumably due to locally different polymerisation conditions. A skin-core structure was found in carbon fibres, corresponding to an increased transverse modulus towards the interface.