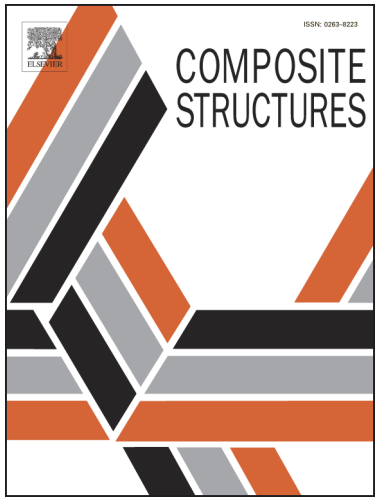

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High-temperature fatigue behaviour of notched quasi-isotropic thermoplastic and thermoset laminates: influence of matrix ductility on damage mechanisms and stress distribution

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ABSTRACT

A study has been undertaken on the fatigue of notched carbon fibre reinforced polymers with ductile PolyPhenylene Sulfide (PPS) thermoplastic versus brittle epoxy thermoset matrix, with underlying damage mechanisms observed at micro- and mesoscopic levels. Through the comparison with a brittle matrix system (C/epoxy) tested at $T<T_g$, highly ductile C/PPS laminates have been tested at $T>T_g$ to investigate the influence of matrix ductility on the redistribution of stresses and resulting damage mechanisms near the hole. SEM and X-rays observations provide experimental evidence to support the discussion on the specific role of matrix ductility in the delay of matrix cracking, and its contribution to slowing down inter- and intra-laminar crack propagation during fatigue loading. This mechanism seems to increase material toughness, as these matrix-rich regions at the microscopic level act as a crack barrier, resulting in localized damage in the vicinity of the hole. It can be concluded that the fatigue behaviour (wear-in) observed in unnotched ductile matrix composites shows the opposite trend (wear-out) in notched configuration.

Keywords: A. PMCs; B. Fracture; B. High-temperature; C. Stress concentration; D. SEM