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Abstract

This paper presents detailed experimental information on mode-II delamination development in fibre/epoxy composite materials and provides observations about the process zone in the vicinity of the crack tip. It is shown that the energy dissipated in delamination propagation is spent on two ways (i) creating new fracture surfaces (delamination) and (ii) nonlinear shear deformation in the composite plies adjacent to the delaminating interface. Therefore, the nonlinear process zone is not restricted to the resin-rich interface between the layers, but also extends into the fibre/epoxy composite layers and has a volumetric shape. This is different from the conventional assumption in modelling delamination using cohesive elements where the fibre/epoxy layers are fully linear-elastic and the process zone is lumped at the plane of fracture. Based on the accurately measured displacement field around the crack tip, the experimental traction-separation relation at the interface is found to be trapezoidal which is again different from the conventional bilinear cohesive law.

Keywords: A. Hybrid composites; B. Interface; B. Plastic Deformation; D. Scanning Electron Microscopy; Traction-Separation law