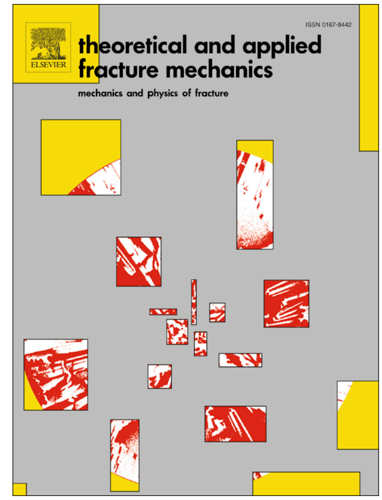

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Abstract

In the present study, the effect of the fiber angle orientation of the delamination interface on the initiation and the propagation fracture toughness of plain woven composites with stacking sequences of $[0_{12}//0_{12}]$, $[0_{11}/30//0/0_{11}]$, $[0_{11}/45//0/0_{11}]$ and $[0_{11}/30//-30/0_{11}]$, where "//" stands for the location of starter delamination in DCB specimens, under mode I loading was investigated. These stacking sequences were chosen so as to eliminate the effects of the remote ply orientation on the delamination behavior of the double cantilever beam (DCB) specimens. The samples were manufactured using the wet hand lay-up method and the fracture tests were conducted on specimens using the universal testing machine according to ASTM standards. The experimental results showed that the interface ply orientation had a negligible effect on the magnitude of initiation and propagation fracture toughness of plain woven composites due to the delamination propagation in the resin-fiber interface of delamination. Experimental investigations of fracture surface demonstrated the impact of different mechanisms on the delamination propagation, where the crack propagation in the resin-fiber interface proved to be one of the primary mechanisms for increasing the fracture toughness of such specimens. In addition, the experimental observations revealed that the fiber bridging was not an influential mechanism for increasing the fracture toughness during the delamination propagation, unlike the unidirectional DCB specimens. In order to predict the experimental load-displacement curve, the traction-separation curve was obtained using the J-integral approach and experimental data. Then, using the obtained curve, the crack initiation and propagation of DCB specimens was simulated by

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