Experimental and numerical study of the micro-mechanical failure in composites

The fibre/matrix interfacial debonding is found to be the first microscale failure mechanism leading to subsequent macroscale transverse cracks in composite materials under tensile load. In this paper, the micromechanical interface failure in fiber-reinforced composites is studied experimentally and by numerical modeling by means of the finite element analysis. Two fibers embedded in the matrix are subjected to a remote transverse tensile load (see Fig. 1a). The trapezoidal cohesive zone model proposed by Tvergaard and Hutchinson [14] is used to model the fracture of the fiber-matrix interfaces. This study is based on the comparison between the results of numerical modeling and those corresponding to the experimental tests by employing two parameters: The angle from the load direction to the crack tip and the crack normal opening. This comparison aims to investigate the interfacial properties and also assess the progressive fiber-matrix debonding by focusing on the interaction of two fibers with dissimilar interfacial strengths.

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