

Measurement of the interfacial strain energy release rate of adhesively bonded structures with metallic substrates before and after water ageing

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Abstract

In order to measure the interfacial Strain Energy Release Rate (SERR) of adhesively bonded joints with metallic substrates, an alternative to the Tapered Double Cantilever Beam (TDCB) specimen is used here. In particular, the dimensions of one of the two substrates were reduced to create an Asymmetric Tapered Double Cantilever Beam (ATDCB) specimen. The ATDCB specimen has been introduced in the past by other research teams to study the mode I+II cohesive fracture properties of structural adhesives. It is shown the geometric dissymmetry of the ATDCB specimen affects the crack propagation path towards the interface with the smaller (less stiff) substrate. However, this substrate plasticises during the fracture test; hence, a strategy is also presented to evaluate the amount of potential energy spent for this phenomenon and subtract it from the total potential energy induced in the system during the fracture test. After this operation, the SERR of the adhesive under investigation was calculated by means of the Linear Elastic Fracture Mechanics (LEFM) theory before and after water ageing. The results showed a large decrease of the SERR with the increase of the ageing time.

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