Investigation of Mode II Fracture Toughness in Orthotropic Materials

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Abstract : Evaluation of mode II fracture toughness (KIIC) in composite materials is very hard problem to be solved, since it can be affected by many mechanisms of dissipation. Furthermore, non-linearity in its behavior can offer an extra difficulty to obtain accuracy in the results. Different reported values for KIIC in various references can prove the mentioned assertion. In this research, some solutions proposed based on the form of necessary corrections that should be executed on the common test fixtures. Due to the fact that the common test fixtures are not able to active toughening mechanisms in pure Mode II correctly, we have employed some structural modifications on common fixtures. Particularly, the Iosipescu test is used as start point. The tests are applied on graphite/epoxy; PMMA and Western White Pine Wood. Also, mixed mode I/II fracture limit curves are used to indicate the scattering in test results are really relevant to the creation of Fracture Process Zone (FPZ). In the present paper, shear load consideration applied at the predicted shear zone by considering some significant structural amendments that can active mode II toughening mechanisms. Indeed, the employed empirical method causes significant developing in repeatability and reproducibility as well. Moreover, a 3D Finite Element (FE) is performed for verification of the obtained results. Eventually, it is figured out that, a remarkable precision can be obtained in common test fixture in comparison with the previous one.

Keywords : FPZ, shear test fixture, mode II fracture toughness, composite material, FEM
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