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Finite Element Analyses of Several T-peel Specimen Configurations using Cohesive Zone Models

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Abstract:

T-peel test specimen behavior and test results depend strongly on the specific configuration the specimen assumes during testing. Resulting deformed configurations can be classified into one of four different categories, each requiring its own analysis and interpretation. To illustrate the range of behavior and data that can be obtained, T-peel tests were conducted for specimens with different adherends and adhesives. For the same adhesive, the effects of the adherend material, thickness, and bond length on T-peel test results were investigated. Results revealed that adherend thickness, modulus and yield properties, the adhesion properties, and even the bond length can all influence the resulting data and the category into which a given specimen would fall based on whether self-similar debonding is achieved whether plastic deformation occurs. Furthermore, comparisons of different metrics that might be of interest for a T-peel configuration in interpreting results were given. The finite element method was employed to characterize the test specimens studied. The analysis allowed for subtracting the calculated plastic dissipation from the measure peel energy, resulting in extraction of a more meaningful fracture energy. A cohesive element technology that is implemented in the Abaqus was used to model the elastic-plastic T-peel tests. These predictions showed excellent agreement with experimental observations. Comparing with the experimental results, the numerical calculations quantitatively caught the features of the deformation, and confirmed that T-peel tests can result in highly exaggerated fracture energy unless careful analysis is conducted to subtract the energy involved in deforming adherend plastically from the apparent peeling energy.