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A COMBINED EXPERIMENTAL AND COMPUTATIONAL STUDY ON SHEAR STRENGTH DISTRIBUTIONS FOR BONDED POLYMERS AND COMPOSITES

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ABSTRACT

Dissimilar material interfacial joints can be found in numerous modern engineering and science fields. One major research effort has been the evaluation of interfacial strengths of dissimilar materials. The current work will be an integrated experimental and numerical investigation on the effect of the non-uniform stress distributions on the interfacial shear strength measurements of bonded polymers and composites.

One shear strength measurement is the Iosipescu shear strength tests, and the second measurement is the short beam shear tests without the V-notch modification. The transverse shear stress states of these two kinds of specimens are quite different. For the short-beam shear specimen, its shear stress distribution will be a parabolic distribution and is not uniform. So the final shear failure will generally not initiate from the upper and low edges of the beam specimen due to very low shear stress. On the other hand, a uniform shear stress distribution could be achieved in the Iosipescu shear specimen so the final shear failure might occur at any location. We compared the average strengths and standard deviations of these two approaches. We have utilized the in-situ photoelasticity to record fringe patterns till failure and have compare these patterns obtained from numerical fringe using the finite element method. Finally, we simulate the shear strength distribution using Monte Carlo simulations and a micro-mechanics flaw model. Both experimental study (20-30 specimens for each case) and numerical simulation show that the difference of the shear bonding strengths of two kinds of specimens is around 10%. Therefore, using the Iosipescu shear strength test is not necessary.