

Comparative Analysis of 0° Tensile Fatigue Specimen Configurations and Failure Mechanisms in Unidirectional Tape Composites: Postprint

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Abstract

Experimental and simulation-based comparative studies were conducted on two commonly used specimen configurations for 0° tensile fatigue testing of unidirectional tape composite materials. Non-contact measurement methods were employed to obtain the strain distributions of both configurations under tensile loading, revealing that the double-dumbbell type specimens exhibited significant edge effects and more severe stress concentration. Simultaneously, stress contour plots of the two configurations under tensile loading were acquired through simulation analysis, which also indicated severe stress concentration in the double-dumbbell type. Examination of specimen edges via electron microscopy revealed that machining leads to surface damage, with the double-dumbbell type causing more extensive fiber damage during the machining process, which is detrimental to load-bearing capacity. The experimental and analytical results demonstrate that straight-strip type specimens are more suitable than double-dumbbell type specimens for conducting tension-tension fatigue threshold tests on carbon fiber reinforced composite materials.

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