

Numerical Study on Tear Resistance of Short-Fiber-Filled Rubber Composites (Postprint)

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Abstract

Based on fracture mechanics theory, the finite element method is applied to analyze the tearing characteristics of a two-dimensional rubber sheet with an initial edge straight crack under uniaxial tension. The random sequential adsorption (RSA) algorithm is employed to generate models with randomly distributed short fibers in ABAQUS software; the influence of mesh size and integration path on the J-integral is studied; the J-integral values of the composite under different tensile loads are calculated; and the variation of the J-integral (with propagation direction parallel to the initial crack direction) with short fiber content, short fiber length, short fiber diameter, and short fiber orientation angle is analyzed. The results show that: mesh size and integration path have a certain influence on the J-integral; the J-integral increases with increasing tensile load; under the same initial edge straight crack ($a_0=6.25$ mm), the tear resistance of short fiber-filled rubber composites improves with increasing short fiber content, length, and diameter, and decreases with increasing short fiber orientation angle; and the tear resistance of short fibers randomly oriented within a small angle range is superior to that within a large angle range.

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