Continuum approach for modeling fatigue in amorphous glassy polymers. Applications to the investigation of damage mechanisms in polycarbonate.

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Abstract

In this study, we attempt to elucidate how the various micro-mechanisms contribute to the fatigue development in an amorphous glassy matrix. To investigate this issue, we propose an approach suitable for modeling fatigue in amorphous polymers. The studies are based on finite element analyses of a dogbone-shaped test specimen featuring plastic instabilities and localization behavior. Also discussed is the development of fatigue damage in toughened polymers, in view of dispersed particles. The results show that the fatigue damage initiates at the sites following closely the localization of the plastic deformations or instabilities, while the concentrated regions of hydrostatic stress were essentially different. The more rigid the inclusions are, the more intensive the damage growth in the ligaments between the inclusions, while the rigidity has no impact on the location of the matrix damage. On the basis of the results, the micro-mechanism which will trigger fatigue damage is discussed.

Keywords: fatigue damage, amorphous polymers, endurance surface, inclusions, FEM

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