Plastic Zone Size and Brittleness of Polymeric Materials

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Abstract

Polymeric materials have been widely used in many industrial applications. They have gained increasing interest due to cost and performance purpose. In this paper, plastic zone sizes near the crack tip of polymers are investigated based on the Dugdale's model, the Irwin's estimation and the elastic solution. The linear elastic fracture mechanics commonly predicts a stress singularity at the crack tip. For ductile materials, a crack initiation and extension requires consideration of a large scale of plastic deformation. In the case of small scale yielding, the size of the plastic zone for brittle materials is confined in a small region surrounding the crack tip. Thus, the linear elastic fracture mechanics approach may be used to estimate crack growth with some adjustments. The relationship between plastic zone size and the value of brittleness is examined in this work.

Keywords: Polymer, Plastic Zone Size, Brittle, Fracture Mechanics