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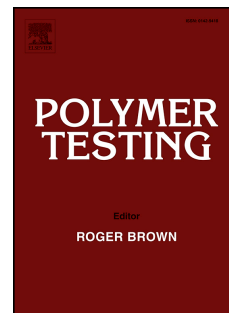
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Material Properties

## Fracture and fatigue of silica/carbon black/natural rubber composites

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*J*-integral theory and fatigue testing were adopted to investigate the fracture and fatigue properties of silica/carbon black(CB)/natural rubber composites with total filler content of 50 phr. Critical *J*-value  $J_{IC}$  and tearing modulus  $T_R$ , were obtained.  $J_{IC}$ , as an indicator of crack initiation resistance, was dependent on the pre-cut length.  $T_R$  was related to the crack propagation of the composite. With increasing the silica/CB ratio, both  $J_{IC}$  and  $T_R$  were enhanced, indicating that the resistance to crack initiation and propagation were improved. The strain energy density at a fixed strain decreased with an increase in the silica/CB ratio. Fatigue testing under constant tensile strain conditions demonstrated that the composite with higher silica/CB ratio exhibited lower cyclic crack growth rate and longer fatigue life. This was in accordance with the results of  $T_R$ ,  $J_{IC}$  and strain energy density of the composite, hence  $T_R$ ,  $J_{IC}$  and strain energy density of the composite can be used to predict its fatigue properties.

**Keywords:** Natural rubber composites, strain energy density, *J*-integral, crack growth rate, fatigue life

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