

عنوان مقاله:

A Study on the fracture behavior of polyethylene/calcium carbonate nanocomposites using the essential work of fracture (EWF) method

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خلاصه مقاله:

In the case of ductile materials such as thin plastic films, the applied stress state in front of the crack tip is in a plane stress condition and the deformation around the crack tip is very large. Thus linear elastic fracture mechanics (LEFM) can not be employed to elucidate the fracture behavior of such materials. Recent studies have shown that the essential work of fracture (EWF) method can be a very useful tool for studying the fracture properties of thin films particularly of ductile films. In the current research, the fracture behavior of polyethylene (PE) films including pure and reinforced with different content of nano size calcium carbonate was investigated by means of EWF method under mode I loading. For this purpose deeply double edge notched (DDEN) specimens with ligament lengths ranging from 5 to 15 mm cut from compression molded films and subjected to tensile tests at a constant crosshead speed of 5 mm/min. The essential (w_e) and non-essential work of fracture (βw_p) were estimated from plots of the specific total work of fracture (w_f) versus ligament length. The fracture surfaces of MDPE and nanocomposites were studied by scanning electron microscopy (SEM). The results showed that w_e of PE/CaCO₃ nanocomposites was lower than that of neat PE, while βw_p increased with increasing CaCO₃ content up to 2.5wt%, and then decreased for the nanocomposites containing 5wt% CaCO₃. The observed trend in the toughness parameters (i.e. w_e) was well demonstrated by the microscopic evaluation.

کلمات کلیدی:

Essential work of fracture (EWF); Nanocomposite; Polyethylene; CaCO₃

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