

NATURAL AND ARTIFICIAL WEATHERING OF POLYETHYLENE COMPOSITES

Rui Yang, Wei Li, Ying Liu, Jian Yu, Kunhua Wang

Department of Chemical Engineering, Tsinghua University, Beijing, P. R. China

Abstract

Mineral fillers such as talc, wollastonite, kaolin, mica, etc., have been widely used in polymer materials in order to improve their mechanical properties, gas barrier performance and heat resistance, and cut down the cost as well. However, their effects on durability of polymer materials did not attract enough attention. Natural and artificial photo-oxidation degradation of some polyethylene (PE) composites was carried out outdoors and in an accelerated weathering oven respectively. The chemical structure and morphology changes during the test period were characterized by a Fourier transform infrared spectroscopy (FTIR) coupled with an infrared microscope and a scanning electron microscopy (SEM). Meanwhile, the mechanical properties changes with time were measured. In the outdoor test, mineral fillers had quite different effects on the photo-oxidation degradation of PE. Some (e.g. kaolin) decreased the stability of PE greatly with much higher carbonyl build-ups and earlier crack formations. The oxidation profile development was consistent with the crack propagation. Some (e.g. talc) did not change or increased the stability of PE a little, with quite low oxidation levels and no crack. However, in the artificial test, the different PE composites did not show great difference both in oxidation profiles and in crack morphologies. This should be attributed to the vigorous irradiation which covered up the difference of different composites to some extent. Therefore, life-time prediction of polymer materials from accelerated artificial weathering test should be done with great carefulness.