

INHOMOGENEITY OF PHOTODEGRADATION PROCESSES IN BULK COMODITY POLYMERS SUBJECTED TO ACCELERATED WEATHERING STUDIED BY ESRI AND OTHER PHYSICAL METHODS

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Abstract

Photodegradation of bulk polymers comprises a large number of chemical and physical processes which for a number of reasons affect distinct regions in the material in various time scales and with different intensity. Understanding reasons resulting in such inhomogeneity of the degradation processes is of extreme importance for improving stabilization of polymers and minimizing negative impact of weathering on their material properties. We adopted modern physical techniques in studies of spatial distribution of intermediates and products of degradation processes and for determination of changes in physical properties of stabilized commodity polymers during accelerated aging. Concentration profiles of nitroxides, key intermediates in the protection mechanism of hindered amine stabilizers (HAS), inside 6 mm thick plates along the direction perpendicular to their irradiated surface were determined by electron spin resonance imaging (ESRI) in dependence on the duration of the accelerated weathering. In the same dependence changes in polymer transparency, changes in concentrations of carbonyl and hydroxy groups on the surface and inside the samples, and changes of integral mechanical properties of polymers were studied. Experimental results show development of concentration gradients of products and intermediates of degradation processes. Interpretation of the observed heterogeneity is based on model of diffusion limited oxidation (DLO) and penetration of radiation through the polymers (their transparency) measured in the course of the degradation.

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