

Accelerated Photo-oxidation of Polyamide 11 Nanocomposites under Various Clays Nanofillers

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Abstract.

The developpement of PA11/clay nanocomposite with high-performances is an interesting research domain due to widespread applications of such materials. Therefore, the knowledge of their durability under specific service conditions is a prerequisite to predict their functional properties [1]. In this work, the effects of various clays nanofillers on the photo-oxidation of PA11 have been investigated by accelerated UV test up to 780h. Organo-modified montmorillonite, halloysite nanotubes and sepiolite were selected and incorporated separately to the polymer matrix at 5 wt. %. The nanocomposite samples were prepared by melt compounding. The study reveals that accelerated photo-oxidation induces changes in the FTIR spectra of both neat polymer and PA11 nanocomposites with the formation of carbonyl products, mainly imides. Moreover, the FTIR data show a linear increase for carbonyl index (CI) during the first 360h of exposure reflecting rapid oxidation of all samples without any induction period. The FTIR data indicate also the dependency of the photo-oxidation rate on the type of clays. Although, the nanocomposites samples exhibit fast oxidation kinetics than the neat polymer, however less pronounced for PA11/sepiolite. This result is consistent with the yellowing index (YI) evolution determined by UV-vis spectroscopy. Furthermore, DSC measurements indicate a rapid increase in the crystalline index (X_c) for all samples at the initial stage of aging, before decreasing at longer exposure time meaning that photo-oxidation damagingly affects the crystalline regions of the irradiated samples. Furthermore, the onset oxidation temperature (OOT) values determined by DSC agree with FTIR and UV-Visible data.

1. M. Kaci, N. Dehouche, W. W. Focke, E. M. Van der Merwe. Polym. Eng. Sci. 59, 2019, 2449-2457.