Accepted Manuscript

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PII: S0141-3910(16)30154-9

DOI: 10.1016/j.polymdegradstab.2016.05.024

Reference: PDST 7971

To appear in: *Polymer Degradation and Stability*

Received Date: 20 May 2016

Accepted Date: 26 May 2016

Please cite this article as: Gijsman P, Dong W, Quintana A, Celina M, Influence of temperature and stabilization on oxygen diffusion limited oxidation profiles of polyamide 6, *Polymer Degradation and Stability* (2016), doi: 10.1016/j.polymdegradstab.2016.05.024.

Influence of temperature and stabilization on oxygen diffusion limited oxidation profiles of polyamide 6

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Key words: polyamide 6, Copper, Irganox® 1098, diffusion limited oxidation, oxidation profiles, IR and UV-spectroscopy, mechanical properties

Abstract

The oxidative degradation behavior of polymers depends on a combination of chemical and physical factors, with oxygen diffusion being one of the most important, especially when the oxygen consumption rate is larger than its permeability.

As a result of diffusion limited oxidation (DLO), at high temperatures the degradation rate of polyamide 6 (PA6) plaques is heterogeneous, with the polymer oxidizing much faster at the surface than in the bulk. Normalized carbonyl index (CI) and UV absorption – depth profiles were found to be mostly degradation time independent, implying equilibrium degradation conditions where oxygen permeability and reaction rates did not change significantly with degradation time. The experimental DLO profiles were described using a basic reactive-diffusion model based on Fickian oxygen diffusion and an oxidation rate being first order in local O_2 concentration, as well as by applying an established DLO model based on the basic autoxidation mechanism. Analysis with the second model yielded the best estimation of high temperature