EuroSciCon

World Congress on

Materials Science & Engineering

August 23-25, 2018
Amsterdam, Netherlands

M Yazdan Mehr et al., Nano Res Appl 2018, Volume: 4
DOI: 10.21767/2471-9838-C4-018

DEGRADATION MECHANISMS OF BISPHENOL A POLYCARBONATE (BPA-PC) IN LED-BASED PRODUCTS

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This paper aims studying the main reason of ageing of optical materials used in LED-based products. Solid state lighting (SSL) and more specifically LEDs, are known to be a revolutionary invention in the lighting industry and are expected to completely replace traditional less efficient light sources. A solid-state lighting system is composed of an LED chip with electronic driver(s) integrated in a package that provides optical functions, thermal management and/or other functions. White LEDs are multipart systems. Apparently, each of these components can break and induce failure. Optical degradation of white LED products is mainly due to the aging of the encapsulants/lens. Optical degradation of the products is mainly due to the ageing of BPA–PC encapsulants under Thermal exposure and light radiation. In this study, BPA–PC plates are aged at different temperatures and light intensities. The results show that increasing the exposure time leads to the discoloration, loss of optical properties, decrease of light transmission, and increase in the yellowing index (YI) of BPA–PC plates leading to a reduction of light intensity and even early failure before the expected lifetime of the instrument. Reliability models such as Arrhenius and Eyring equations are used to predict the life time of the samples at different time. In order to prevent the ageing of BPA-PC a graphene monolayer has been successfully coated on one side of a bisphenolA-polycarbonate (BPA-PC) plate, it is shown that graphene monolayer considerably increases the lifetime of LEDs mainly by shielding them against exterior degradation reasons such as moisture and oxygen. This method has excessive potential to improve the reliability of not only LED-based products but also many other microelectronics packaging and components, in which moisture and oxygen are the key causes of failures.

Biography

Maryam Yazdan Mehr did her PhD at Delft University of Technology from 2011 to till 2015, associated with Professor Zhang and Professor van Driel in the ECTM group at TU Delft. During her PhD, she worked on Organic Materials Degradation in Solid State Applications. During this project, the reliability and degradation of LEDs was for the first time studied from both materials and system perspective. One of the greatest achievements in this project was developing a high accelerated ageing test methodology. The set-up and the concept are now being used by Philips Lighting. So far, she has published almost 16 journal papers, more than 10 conference papers, and a book chapter. After her PhD, she applied for an HTSM grant as a Post-doc and it was granted in 2016. In June 2017, she started her Post- doc project entitled Reliability of Optical Materials in LED-based Products under Harsh Environments in the group of Professor Zhang at TU Delft.

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