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Research Article

A Simple Optical Model for the Swelling Evaluation in Polymer Nanocomposites

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Abstract

In the present study, we report on a simple optical method based on thin film interferometry for the swelling evaluation in polymer nanocomposite layers used for gas sensing applications. We show that white light interferometry can be profitably applied to characterize scattering materials such as polymer/carbon black nanocomposites. A properly adjusted experimental setup was implemented to monitor the swelling behavior of the sensitive films in real device operating conditions. In particular, the behavior of poly(2-hydroxyethyl methacrylate) (PHEMA) and of carbon black/PHEMA nanocomposite layers, used for volatile organic compounds (VOCs) detection, was investigated and measured under ethanol vapors exposure (max 1%). The method is very sensitive and the swelling in the range of only few nanometers can be measured. Interestingly, we have found that the nanocomposite undergoes a more pronounced swelling process with respect to pristine polymer. Ethanol diffusion coefficients in the nanocomposite were evaluated.

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