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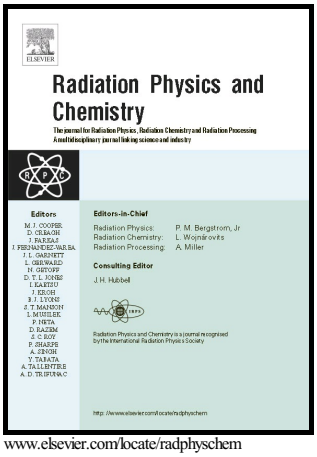

www.elsevier.com/locate/radphyschem

PII: S0969-806X(16)30702-2
DOI: http://dx.doi.org/10.1016/j.radphyschem.2016.11.012
Reference: RPC7324

To appear in: *Radiation Physics and Chemistry*

Received date: 12 July 2016
Revised date: 29 October 2016
Accepted date: 21 November 2016

Cite this article as: D. El-Sayed, A.A. El-Saftawy, S.A. Abd El Aal, M. Fayez-Hassan, M. Al-Abyad, N.A. Mansour and U. Seddik, Neutron-induced modifications on Hostaphan and Makrofol wettability and etching behaviors *Radiation Physics and Chemistry* http://dx.doi.org/10.1016/j.radphyschem.2016.11.012

Neutron-induced modifications on Hostaphan and Makrofol wettability and etching behaviors

D. El-Sayed [a], A.A. El-Saftawy [b,*], S.A. Abd El Aal [c], M. Fayez-Hassan [d], M. Al-Abyad [a], N.A. Mansour [e], U. Seddik [d]

[a] Experimental Nuclear Physics Department (Cyclotron Facility), Nuclear Research Center, Atomic Energy Authority, P.O. 13759, Cairo, Egypt

[b] Accelerators and Ion Sources Department., Nuclear Research Center, Atomic Energy Authority, P.O. 13759, Cairo, Egypt

[c] Central Lab. for Elemental and Isotopic Analysis, Nuclear Research Center, Atomic Energy Authority, P.O. 13759, Cairo, Egypt

[d] Experimental Nuclear Physics Department, Nuclear Research Center, Atomic Energy Authority, P.O. 13759, Cairo, Egypt

[e] Physics Department, Faculty of Science, Zagazig University, P.O. 44519, Zagazig, Egypt

[*] Corresponding author e-mail: aama1978@yahoo.com, Tel: 002 01142118813

Abstract

Understanding the nature of polymers used as nuclear detectors is crucial to enhance their behaviors. In this work, the induced modifications in wettability and etching properties of Hostaphan and Makrofol polymers irradiated by different fluences of thermal neutrons are investigated. The wetting properties are studied by contact angle technique which showed the spread out of various liquids over the irradiated polymers surfaces (wettability enhanced). This wetting behavior is attributed to the induced changes in surface free energy (SFE), morphology, roughness, structure, hardness, and chemistry. SFE values are calculated by three different models and found to increase after neutrons irradiation associated with differences according to the used model. These differences result from the intermolecular interactions in the liquid/polymer system. Surface morphology and roughness of both polymers showed drastic changes after irradiation. Additionally, surface structure and hardness of pristine and irradiated polymers were discussed and correlated to the surface wettability improvements. The changes in surface chemistry are examined by Fourier transform infrared spectroscopy (FTIR), which indicate an increase in surface polarity due to the formation of polar groups. The irradiated polymers etching characteristics and activation energies are discussed as well. Lastly, it is evident that thermal neutrons show efficiency in improving surface wettability and etching properties of Hostaphan and Makrofol in a controlled way.

Keywords: Neutrons, Hostaphan, Makrofol, Wettability, Surface energy, Chemical etching.