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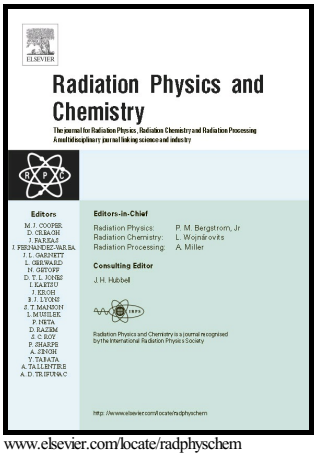

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ABSTRACT

In the present study, electron beam (EB) is utilized to tailor the surface structure and wetting behavior of ethylene-vinyl alcohol (EVOH) copolymer. The structural deformation is examined by x-ray diffractometer (XRD). The recorded patterns reveal the formation of disordered systems on the irradiated surface. Also, the surface crystallinity degree, crystallite size, and micro-strain are studied. The microstructure induced modifications of the irradiated samples are investigated by 1-dimensional proton nuclear magnetic resonance ^{1}H NMR spectroscopic analysis. The recorded spectra showed that the hydroxyl group (O–H) absorption intensity, enhanced compared to that of methylene (–CH_2) and methine (>C–H) groups. Likewise, the changes of the polymer surface chemistry are studied by Fourier transform infrared spectroscopy (FTIR) and showed that the surface polarity improved after irradiation. The contact angle method is used to prove the surface wettability improvements after irradiation. Additionally, the fucoidan-coated samples exhibit great enhancements in surface wettability and have a reduced recovery effect compared to the uncoated samples. The surface free energy and bonding adhesion are studied as well. The fucoidan-coated samples are found to have a larger adhesion strength than that of the EVOH samples (pristine and irradiated). Finally, surface morphology and roughness are traced by atomic force microscopy (AFM). The improvements in surface wettability and adhesion are attributed to the modified surface roughness and the increased surface polarity. To sum up, combining EB irradiation and fucoidan enhance the surface wettability of EVOH in a controlled way keeping the bulk properties unaffected.

Keywords: Electron beam; EVOH copolymer; Polymer structure; Adhesion strength; Wettability recovery.