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HIGH GAS BARRIER PROPERTIES OF PVA NANOCOMPOSITE FILMS WITH EQUI-BIAXIAL STRETCHING

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Barrier property enhancement in composite films was known to depend on several factors, such as the quantity, length, and width of the clay particles, as well as their orientation and dispersion. Numerous studies showed that the aspect ratio of exfoliated clay particles played a critical role in controlling the microstructure of polymer-clay nanocomposites and their gas barrier performance. This article reported the rate of oxygen diffusion across PVA/SPT nanocomposite films that were formed by equi-biaxial stretching of PVA nanocomposite materials at different stretching ratios. The materials were prepared by mixing a solution of the pristine clay with PVA pellets. The exfoliated PVA nanocomposite films were stretched equi-biaxially at 120℃. The resultant gas barrier properties were discussed in terms of the relative nanocomposite particle orientations in the hybrid films. We also examined the relationship between the gas barrier and the clay loading using wide-angle X-ray diffractometry (XRD), transmission electron microscopy (TEM), and gas permeation detection. Poly(vinyl alcohol) (PVA) hybrid films containing 5 wt% saponite clay mineral were synthesized using a solution intercalation method. Hybrid films were equi-biaxially stretched with stretching ratios that ranged from 100% to 300%. The clay dispersion, morphology, and gas permeability were examined as a function of the equi-biaxial stretching ratio. PVA hybrid films with ? 200% stretching displayed homogeneously dispersed clay in the polymer matrix and exfoliated nanocomposites. The films showed the highest barrier to oxygen permeability at the equi-biaxial stretching ratio of 300%.