Utilization of High-Speed Melt Spun Bicomponent Fibers for the Preparation of Reflective Polarizing Film

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Reflective polarizing films (RPF) consisting of multi-layered structure with controlled optical anisotropy attracts much attention these days since such films can be utilized for the improvement of the brightness of liquid crystalline displays. In this research, we tried to utilize the high-speed melt spinning process for the preparation of fibers applicable for the production of RPFs. When sheath-core bicomponent fibers were prepared using Poly(ethylene 2-6-naphthalene dicarboxylate) (PEN) as the sheath and polystyrene (PS) as the core, refractive index of both components in the direction perpendicular to the fiber axis, n-perp, were similar whereas that in the direction parallel to the fiber axis, n-para, showed significant difference at the take-up velocity of around 3.5 km/min. On the other hand, when sheath-core bicomponent fibers were prepared using poly(1-4-cyclohexylene dimethy-lene terephthalate) (PCDT) as the sheath and PS as the core, n-para of both components were similar where as n-perpwere different at the take-up velocity of around 4.5 km/min. The islands-in-the-sea type bicomponent fibers of PEN/PS and PCDT/PS were also prepared under similar spinning conditions and wavelength-dependent transmittance of those fibers was evaluated. When the incident light was polarized parallel to the fiber axis, PEN/PS fiber showed transmittance of around 50% whereas PCDT/PS fiber showed that of close to 100%. On the other hand, when the incident light was polarized perpendicular to the fiber axis, transmittance of PEN/PS fiber was slightly lower than 100 % whereas that of PCDT/PS fiber was around 80%. High reflectivity of PEN/PS is due to the significant difference of n-perp between the two components whereas high transmittance of PCDT/ PS is due to the perfect matching of n-perp between the two components. The RPFs were prepared embedding the aligned PEN/PS or PCDT/PS fibers in UV-curable resins of controlled refractive indices.