

Vertical Orientation of Liquid Crystal on Tocopherol-modified Polystyrene Films

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We synthesized a series of bioavailable and vitamin-based tocopherol-substituted polystyrene (PTOC#, # = 20, 40, 60, 80, 100), where # signifies the molar ratio of tocopherol moiety, using polymer analogous reactions to investigate their liquid crystal (LC) orientation properties. Commonly, the LC cell made using polymer film having a higher molar ratio of tocopherol side group of PTOC# showed vertical LC orientation behavior. The vertical orientation behavior was closely related to surface energy value of PTOC# polymer films. For instance, vertical orientation was observed when surface energy values of these polymer were smaller than about 35.22 mJ/m² generated by nonpolar tocopherol moiety having long and bulky carbon groups. Good electro-optical characteristics (e.g. voltage holding ratio (VHR) and residual DC voltage (R-DC)) and aligning stabilities at 200 °C and ultraviolet irradiation of 10 J/cm² were observed for LC cells fabricated using PTOC100 as a LC orientation layer. Therefore, it was the first found that the renewable tocopherol-based materials can produce a green vertical LC orientation system.