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Surface effects on 2-dimensional anisotropic phase separation from liquid crystal and polymer composites

Y. J. Lee, M. Y. Jin, J. W. Jung, H. R. Kim, Y. Choi, J. H. Kim, and K. S. Bae

Department of Electronics and Computer Engineering, Hanyang University, South Korea

We investigate the effect of surface wetting property on the 2-dimensional anisotropic phase separation. In the previous works of liquid crystal (LC) and polymer composite system, it was found that surface wetting difference in LC and polymer plays an important role even in the photo-polymerization induced phase separation. In this work, 2-dimensional phase separation in lateral direction was obtained without UV irradiation by controlling the degree of surface wetting difference with a patterned alignment layer. The surface condition was spatially modified by laminating several types of alignment materials on the ITO substrate in a periodic square pattern using micro-contact printing method. Experimental results showed surface interactions of LC and polymer with the patterned substrate affect the distribution of LC and polymer after phase separation. The relative wettability of LC and polymer on alignment layer and ITO surface determined the diffusion direction of each material during phase separation. Therefore, even in the same LC/polymer composites, the volume fraction of LC to polymer can be higher on the alignment layer or ITO surface depending on patterning condition. Such phenomena were described by numerical simulation based on 1-dimensional diffusion equation of binary mixture with surface interaction parameters. The simulation results obtained by varying material parameters showed good agreement with the measured contact angles of LC/polymer on each surface.