Effect of thermal annealing on the order parameter of an aligned liquid crystalline conjugated polymer

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The orientational ordering in liquid crystalline conjugated polymer (LCCP) has been interest in photonic and electronic applications such as organic light emitting diodes (OLEDs) and thin-film transistors [1,2] since their order parameter strongly affects the polarization ratio of the electroluminescence (EL). The rubbing process used in the conventional LC devices is a candidate to achieve the high order parameter in the LCCP [3].

In this work, we investigated effect of thermal annealing with different cooling rate on the orientational ordering of the LCCP. Poly(9,9-di-n-octylfluorenyl-2,7-diyl) (PFO from sigma aldrich) was used as an emitting layer for the linearly polarized EL devices. The PFO film dissolved in toluene was spin-coated onto the rubbed AL22636 (from JSR) as an alignment layer for PFO. For nematic ordering of the PFO, the sample was annealed at 210 °C for 20 min. After thermal annealing, we cooled down the substrate with different cooling rates. As shown in Fig. 1, the quenched sample exhibited lower optical retardation than the sample cooled down with -20 °C/min, which is originated from the high crystallinity at low temperature. Also, the corresponding polarization ratio, defined by a ratio of EL intensities polarized parallel and perpendicular to the rubbed direction, showed the similar behavior.

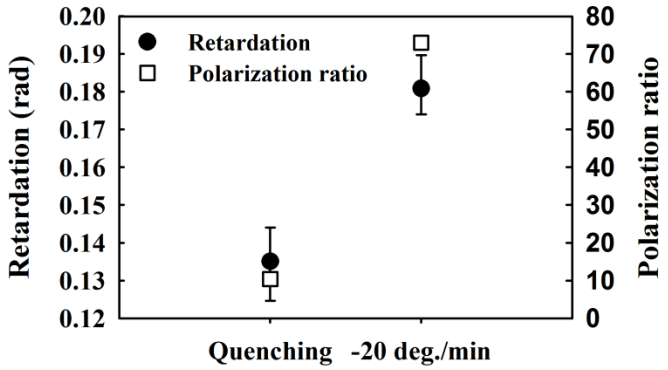

Fig. 1. Optical retardation and polarization ratio of the LCCP film with different cooling rates

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