Circularly Polarized Emission by a Twisted Configuration of Liquid Crystalline Compound

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The circularly polarized (CP) emission in an organic light-emitting diode (OLED) has been studied due to enhancement of the luminance efficiency under an antireflection condition for display applications [1]. For the liquid crystalline (LC) conjugate polymer spin-coated on a rubbed hole-transport layer (HTL), highly CP emission was achieved in the twisted configuration by doping a chiral agent into the conjugate polymer [2]. In general, to produce the twisted structure of the mesogenic polymer, the chiral dopant with high twisting power is required due to high molecular weight and high elastic constant of the polymer. Recently, we synthesized a LC emitting compound with low molecular weight and characterized the general properties of the linearly polarized emission [3].

In this study, the molecular arrangement and the CP emission characteristics in the emitting compound with low molecular weight were investigated in the twisted configuration by the chiral dopant. The synthesized LC emitting compound exhibited the LC phase at 123 °C [3]. After spin-coating the emitting compound on the rubbed HTL of poly(3,4-ethylenedioxythiophene) polystyrene sulfonate, the emitting layer (EML) was annealed at 140 °C (at its LC phase) and processed with two different conditions: slowly cooled to room temperature at 10 °C/min and rapidly quenched with liquid nitrogen. Figure 1 shows the CP photoluminescence (PL) spectra for two different treatments. For the slowly cooled sample, no remarable CP dissymmetry was observed as shown in Fig. 1(a). That is, there is no twisted structure in the EML even in the presence of the chiral dopant due to crystallization of the LC emitting compound. On the other hand, for the rapidly quenched sample, the considerable CP dissymmetry was obtained and the twisted configuration was observed as shown in Fig. 1(b). That is, the twisted configuration in its LC phase at 140 °C was freezed at room temperature by quenching. A general protocol to achieve the high CP dissymmetry of the OLEDs was proposed.

![Fig. 1. CPPL spectra for (a) the slow cooled sample and (b) rapidly quenched sample. Here, I_L and I_R represent the spectra of left-handed CP and right-handed CP emission, respectively.](image)

References