Synthesis and characterization of mesogenic electroluminescent copolymers with iridium-based chromophore

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Generally polarizing plates are used to enhance outdoor visibility of the OLED displays. However, since the OLED emits an isotropic light, the efficiency of light decreases as it passes through the polarizer. If the organic luminescent molecules are anisotropically oriented, the polarized light would be generated due to the birefringence characteristics of the molecules. For this purpose, the most prospective candidate is a liquid crystalline (LC) materials which is possible to manifest spontaneous orientation. If the LC materials possess an anisotropy in the light emitting layer (EML), the polarized light can be generated, and the efficiency deterioration can be reduced when passing through the polarizing plate. Therefore, OLEDs with polarized light emission are advantageous to see under bright sunlight. Furthermore, if a backlight of LCD can be replaced a polarized light source, manufacturing cost can be lowered and energy efficiency can be improved. Recently, mesogenic luminescent materials with phosphorescent chromophore have attracted much attention because they are expected to emit polarized light with high quantum efficiency.

In this study, we have synthesized mesogenic electroluminescent copolymers with an iridium-based phosphorescent chromophore as a lateral substituent. Homo- and copolymers were prepared by varying the feed ratio of co-monomers by polycondensation using a Suzuki coupling method. Copolymers have three repeating units in backbone with different composition ratios: biphenylene, 9,9-diocetylfluorene, and fluorene with bis[2-(1-isoquinolinilyl-N)phenyl-C](picolinato)iridium(III) complex moiety. The structure of homo- and copolymers was identified by 1H-NMR and FT-IR spectrometry. The physicochemical property was investigated by photoluminescence and UV-Vis absorption spectrometry. The thermal behavior was measured by differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA). Information on the molecular weight of copolymers was evaluated by a gel permeation chromatography (GPC). Optical textures were observed using a polarized optical microscope. The HOMO and LUMO levels of copolymers were measured by using a cyclic voltammetry. The polarized ratios of PL and EL lights will be evaluated.

![Structure of mesogenic copolymers](image)

$f = 0, 12.5, 25$ and $37.5$ (mole %)

Fig. 1. Structures of mesogenic copolymers and feed ratio of co-monomer with Ir-complex moiety ($f$).

References