Highly Polarized Light Source with Coatable Polarizer for Brightness-Enhanced Liquid Crystal Display

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External light source and polarizer are indispensable components in liquid crystal display (LCD). Since conventional backlight unit in the LCD emits unpolarized light, we can utilize half of the emitting light at most after passing the polarizer. Recently, the linearly polarized light source has attracted much attention due to improving the brightness of the LCD. Especially, electroluminescence (EL) conjugated polymers with LC phase have of interest as a linearly polarized light source due to their self-orientational ordering [1,2]. In addition, one polarizer in the LCD could be eliminated when the linearly polarized light source was used as a backlight unit [3]. However, the polarization ratio, defined as a ratio of luminous intesities of parallel and perpendicularly polarized components, is still insufficient to remove one polarizer in the conventional LCDs.

In this work, we proposed a highly polarized organic light source with a coatable polarizer (*c*-POL) as a backlight uint for enhancement of the brightness of the LCD. Although an extinction ratio of the *c*-POL was still insufficient for application of the conventional LCDs [4], high contrast ratio was obtained by embedding the *c*-POL to the polarized organic light emitting diode (*p*-OLED). The *p*-OLED was prepared with a emitting layer of poly(9,9-di-n-octylfluorenyl1-2, 7-diyl)-alt-(benzo[2,1,3] thia-diazol-4,8-diyl) (F8BT, American Dye Source) on a rubbed alignment layer of AL22636 (JSR). The polarization ratio of the EL intensity of the *p*-OLED without the *c*-POL was measured to be about 18.7 at 540 nm as shown in Fig. 1(a). When the *c*-POL with an extinction ratio of 22.5 was embedded in the *p*-OLED, the polarization ratio of the polarized light source was increased to be 425 as shown in Fig.1(b).

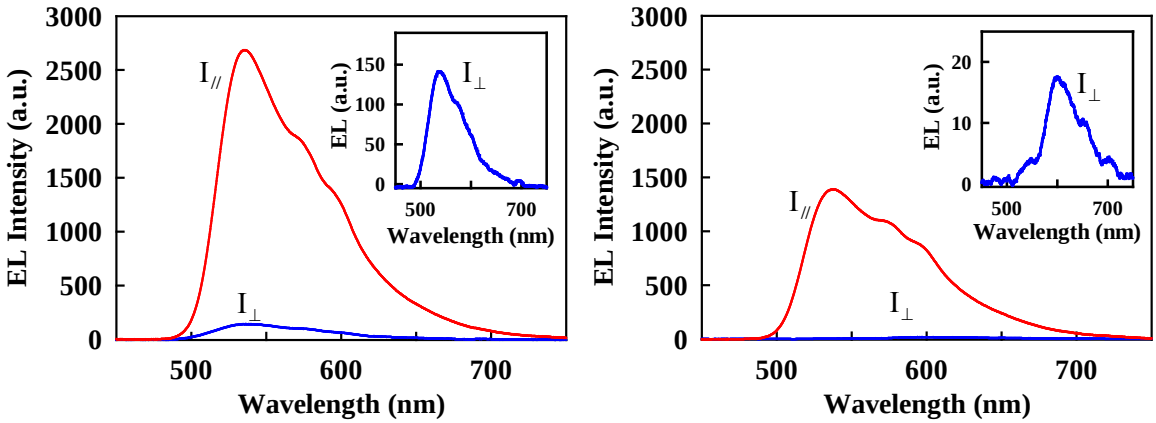

Fig. 1. EL spectra polarized parallel and perpendicular to the rubbed direction of the *p*-OLED (a) without *c*-POL and (b) with *c*-POL. The insets show rescaled spectra of the perpendicular component.

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References

1. 2. D. Matsunaga, T. Tamaki, H. Akiyama and K. Ichimura, *Adv. Mater.*, **14**, 1477 (2002).
2. Z. J. Zheng, K. H. Yim, M. S. M. Saifullah, M. E. Welland, R. H. Friend, J. S. Kim and W. T. S. Huck, *Nano Lett.* **7**, 987 (2007).
3. S. I. Jo, Y. S. Kim, J. -H. Beak, C. -J. Yu and J. -H. Kim, *Jpn. J. Appl. Phys.*, **53**, 03CD04 (2014).
4. Y.-J. Bae, H.-J. Yang, S.-H. Shin, K.-U. Jeong and M.-H. Lee, *J. Mater. Chem.*, **21**, 2074 (2011).