Molecular Crystals and Liquid Crystals Science and Technology. Section A. Molecular Crystals and Liquid Crystals

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/gmcl19

Electroluminescent Properties of Dye-Dispersed Polyurethane with Stilbene Dye Pendant

Hyein Jeong [a] & Chang-Sik Ha [a]

[a] Department of Polymer Science and Engineering, Pusan National University, Pusan, 609-735, South Korea

Version of record first published: 24 Sep 2006

To cite this article: Hyein Jeong & Chang-Sik Ha (1999): Electroluminescent Properties of Dye-Dispersed Polyurethane with Stilbene Dye Pendant, Molecular Crystals and Liquid Crystals Science and Technology. Section A. Molecular Crystals and Liquid Crystals, 337:1, 349-352

To link to this article: http://dx.doi.org/10.1080/10587259908023449

Mol. Cryst. and Liq. Cryst., 1999, Vol. 337, pp. 349-352
Reprints available directly from the publisher
Photocopying permitted by license only

Electroluminescent Properties of Dye-Dispersed Polyurethane with Stilbene Dye Pendant

HYEIN JEONG and CHANG-SIK HA

Department of Polymer Science and Engineering, Pusan National University, Pusan 609–735, South Korea

The dye-dispersed polymer electroluminescent device using soluble polyurethane derivative (PU) with stilbene side chain was prepared. 4-(Dicyanomethylene)-2-methyl-6-(4-dimethylaminostyryl)-4H-pyran (DCM) was used as a lumophore. The DCM-dispersed polymer exhibit strong photoluminescence (PL) in the red spectral region peaking at 640 nm. Single-layer electroluminescent devices with indium-tin-oxide (ITO) and magnesium-silver (Mg:Ag) as electrodes were fabricated via spin-coating from DCM-dispersed PU solution. Red emission was observed from the devices when a DC voltage was exerted. The EL colors turned from green to red by DCM.

Keywords: Dye-dispersed polymer; Polyurethane (PU) derivative; Stilbene; Electroluminescence

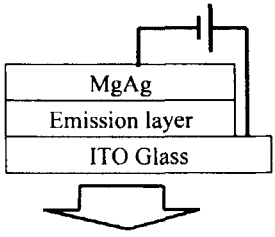
INTRODUCTION

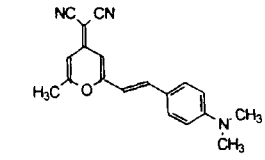
Since the first demonstration of electroluminescene (EL) from a fully π-conjugated polymer,[1] polymeric materials have attracted considerable attention as emissive layers in light-emitting diode structures. A variety of polymer systems, such as fully π-conjugated polymers,[2] polymers with chromophores attached to the main chain or to side chains,[3] and molecularly doped dye-polymer[4] composites have been used. In our previous paper,[5] we reported the synthesis and EL properies of a new EL polymer with an urethane linkage group. In this paper, we report the EL properties of a dye-

dispersed polymer electroluminescent device using the soluble polyurethane derivative(PU) with stilbene side chain.

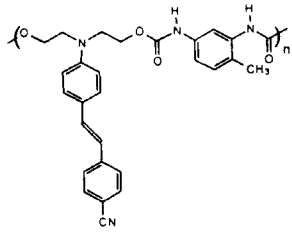
EXPERIMENTAL

In our previous paper,[5] the synthesis of polyurethane with stilbene dye pendant was described. DCM-dispersed PU films with a thickness of approximately 130 nm were fabricated on ITO-coated glass substrates via spin-coating from a 3.0 wt.% THF solution. The weight ratio of DCM to PU was 20/80. The film thickness was determined using a dual-beam interference microscope. The surface of the films appeared homogeneous from an optical microscope image. On top of the polymer layer MgAg (weight ratio 10:1) alloy electrodes with a thickness of approximately 200 nm were fabricated via vapor deposition. The size of the emitting area was 2×2 mm^2 and 8 devices were prepared on the same substrate in a single process under identical conditions. PL and EL spectra were measured using a fluorometer (SFM 25,





DCM



PU

FIGURE 1 The ELD structure and the chemical structures

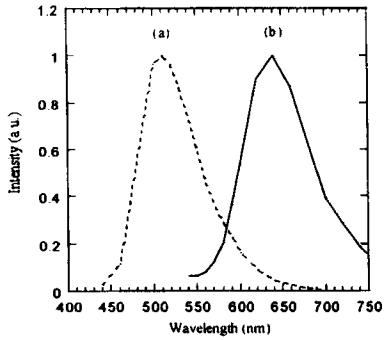


FIGURE 2. PL emission spectra of a spin-coated film of PU(a) and DCM-dispersed PU film with 20 wt.% DCM(b).

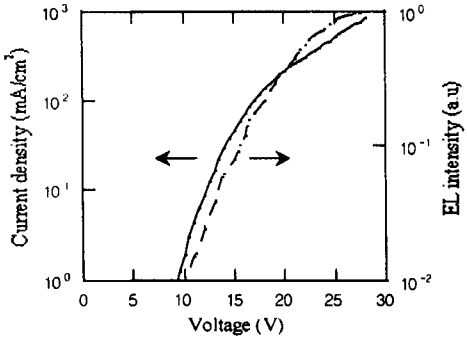


FIGURE 3. Current density-voltage-luminance curves for a DCM-dispersed PU single layer diode.

KONTRON Co.Ltd.). The current density-voltage-luminance characteristics were measured using a photomultiplier tube (PMT) and an electrometer (Keithley 6517). ELD structure and the chemical structures of the materials used in this study are shown in Figure 1.

RESULTS AND DISCUSSION

Figure 2 shows the PL emission spectra of PU and DCM-dispersed PU of a single–layer device. The PL spectrum of PU thin film peaks at 510 nm

whereas the DCM-dispersed PU exhibit strong PL in the red spectral region peaking at 640 nm. Green emission was observed from the devices of PU when a DC voltage was exerted. In the case of the DCM-dispersed PU the EL colors turned from green to red by DCM.

Figure 3 shows the current density and the luminance of the device versus applied voltage. As a result, a luminance of approximately 40 cd/m^2 was observed at the current density of 400 mA/cm^2. A red light was easily observed with human eyes at 15 Vdc.

In conclusion, the single layer EL device using DCM-dispersed PU layer was successfully fabricated. The turn-on voltage was ca. 10 Vdc and the brightness was ca. 40 cd/m^2. However, it is considered that better device charateristics can be performed by applying the optimum concentration of DCM, the appropriate thickness of emitting layer, and the introduction of a multilayer device structure.

Acknowledgments
We would like to thank Professors Tetsuo Tsutsui and Dechun Zou, Kyushu University for the idea of the synthesis of polyurethane derivative used in this work.

References

[1] J. H. Burroughes, D. D. C. Bradley, A. R. Brown, R. N. Marks, K. Mackay, R. H. Friend, P. L. Burn, and A. B. Holmes, *Nature,* **347,** 539 (1990).
[2] D. Braun and A. Heeger, *Appl. Phys. Lett.,* **58,** 1982 (1990).
[3] J. Kido, K. Hongawa, K. Okuyama. And K. Nagai, *Appl. Phys. Lett.,* **63,** 2627 (1992).
[4] T. Tsutsui, C. P. Lin, and S. Saito, *Mol. Cryst. Liq. Cryst.,* **256,** 63 (1994).
[5] H. Jeong, D. Zou, and T. Tsutsui, *Korea-Japan Joint Forum '98* (KJF'98).