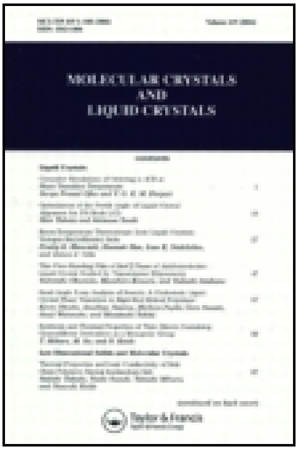

Molecular Crystals and Liquid Crystals Science and Technology. Section A. Molecular Crystals and Liquid Crystals

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

Electroluminescence of Poly Aromatic Hydrocarbon

Sung Taek Lim [a], Dong-Myung Shin [a], Jung-Soo Kim [b], Young Kwan Kim [a] & Yoon Kyung Ha [c]

[a] Dept. of Chem. Eng., Hong-Ik Univ., 72-1, Sangsu-Dong, Mapo-Gu, Seoul, 121-791, KOREA

[b] Dept. of Elect, and Cont. Eng., Hong-Ik Univ., 72-1, Sangsu-Dong, Mapo-Gu, Seoul, 121-791, KOREA

[c] Department of Basic Science, Hong-Ik University, 72-1, Sangsu-Dong, Mapo-Gu, Seoul, 121-791, KOREA

Version of record first published: 24 Sep 2006

Mol. Cryst. Liq. Cryst., 1999, Vol. 327, pp. 209-212
Reprints available directly from the publisher
Photocopying permitted by license only

Electroluminescence of Poly Aromatic Hydrocarbon

SUNG TAEK LIM[a], DONG-MYUNG SHIN[a], JUNG-SOO KIM[b], YOUNG KWAN KIM[a] and YOON KYUNG HA[c]

[a]*Dept. of Chem. Eng., Hong-Ik Univ., 72–1, Sangsu-Dong, Mapo-Gu,Seoul 121–791 KOREA,* [b]*Dept. of Elect. and Cont. Eng., Hong-Ik Univ., 72–1, Sangsu-Dong, Mapo-Gu, Seoul 121–791, KOREA; and* [c]*Department of Basic Science, Hong-Ik University, 72–1, Sangsu-Dong, Mapo-Gu, Seoul 121–791, KOREA*

(Received June 30, 1998; In final form July 30, 1998)

We measured electroluminescence(EL) and photoluminescence(PL) from the poly(N-vinyl-cabazole)(PVK) doped with poly aromatic hydrocarbon(PAH), in this case rubrene. The dependence of thermal process on the PL and EL efficiency was studied. The optimum doping ratio was found to be 1.5mol% for rubrene.

Keywords: electroluminescence; photoluminescence; poly aromatic hydrocarbon(PAH); annealing

INTRODUCTION

Electroluminescence using organic thin film has drawn the attention after Tang reported his first work[1] in 1987. In 1990, Burroughes *et al.* reported green light emission with polyphenylene vinylene(PPV)[2]. Since polymers are chemically more stable and easy to fabricate into devices, conjugated polymers are emerging as new kinds of important materials for EL devices. By doping the conjugated polymers one can get various emitting colors[3,4]. Spin casting is a typical method to fabricate polymers into thin films. To avoid some possible defects of polymer thin films fabricated by spin casting, such as pinholes, the annealing process should be applied. The thermal process can lead polymer thin film to compositional changes[5]. In our work, we investigated the thermal process effects on the luminescence of rubrene-doped PVK thin films.

EXPERIMENTAL DETAILS

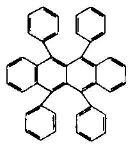

FIGURE 1 Molecular structure of rubrene

The rubrene and PVK are available from Aldrich. The rubrene was purified with sublimation method. PVK was doped with rubrene in molar ratio, 1, 1.5, 2 and 3%, respectively. The solution for the spin casing was prepared with dichloroethane(Aldrich). Thin films fabricated by spin casting were annealed at 130℃ in vacuum(10^{-3} torr). Film thickness and PL spectrum were obtained before and after the annealing. EL devices were constructed in single layer system with ITO cathode and Al anode. EL spectra without annealing were not obtainable.

RESULTS AND DISCUSSIONS

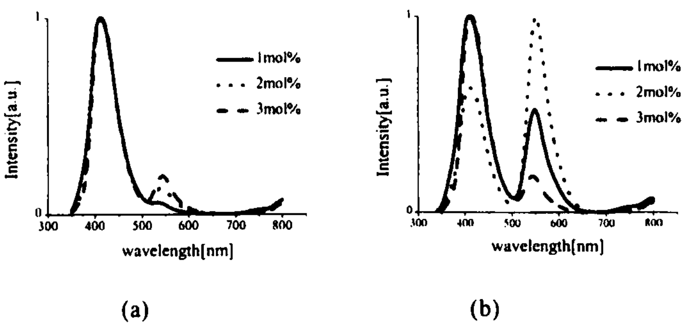

FIGURE 2 PL spectra of rubrene-doped PVK thin films (a) annealed (b) not annealed with different doping ratio.

FIGURE 2 shows the PL spectra of the thin films for the different doping ratios before and after the annealing. After the annealing, the increase of the doping ratio lead to the increase in the emission intensity of rubrene(@560nm) relative to that of PVK. The increment of PL was relatively small, as the doping ratio went higher than 1.5mol%.

With the doping ratio of 1.5mol%, the quantum efficiency for the emission of the rubrene was strongly dependent on annealing time(FIGURE 3).

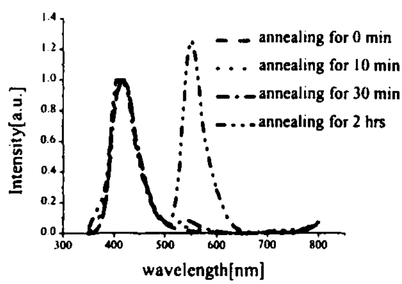

FIGURE 3 PL & EL spectra of rubrene-doped(1.5mol%) PVK thin films as a function of annealing time

Such an improvement of quantum efficiency might be derived from better energy transfer from conducting polymer to dopants.

TABLE 1 Film thickness(Å) of rubrene-doped thin films on Si-wafer with different doping ratio before and after annealing;T_{before} and T_{after} represent film thickness before and after annealing respectively.

	1mol%	1.5mol%	2mol%	3mol%
T_{after}/T_{before}	0.9934	0.9433	0.9395	1.0411

The EL spectra were not obtainable for the EL devices that were not annealed. One of characteristic EL spectra of devices composed of rubrene-doped PVK single layer is shown in FIGURE 4.

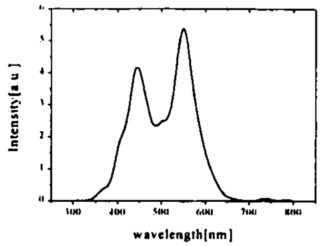

FIGURE 4 Electroluminescence spectra of 1.5mol% rubrene-doped PVK thin film

CONCLUSIONS

Thermal process improved the photoemission efficiency from the dopants in dye-doped conducting polymer thin films. The optimum EL efficiency was obtained with 1.5mol% rubrene-doped PVK thin film.

Acknowledgments
This work was supported by IITA under grant No. C!-98-5170-00.

References

[1] C.W. Tang, and Vanslyke, *Applied Physics Letters,* **51,** 913–915(1987).
[2] J.H. Burreughes, D.D.C. Bredly, A.R. Brown, , R.N. Marks, K. Mackay, R.H. Friend, *Nature,* **347,** 539–541(1990)
[3] C. Hosokawa, N. Kawasaki, S. Sakamoto, and T. Kusumoto, *Applied Physics Letters,* **61,** 2503–2505(1992)
[4] Z.L. Zhang, X.Y. Jiang, S.H. Xu, S. Saito, and T. Nagatomo,, *Chinese Physics Letters,* **12,** 54–57(1994)
[5] Brett D. Ermi, Alamgir Karim, Jack F. Douglas, *Journal of Polymer Science*: Part B, **36,** 191–200(1998)