

## Light-emitting electrochemical cells with block copolymers as luminescent materials

Q.J. Sun, C.H. Yang, Y.F. Li

*Institute of Chemistry, Chinese Academy of Sciences, Beijing 100080, China*

Polymer light-emitting electrochemical cells (LECs) provide a novel approach to light emission from luminescent polymers [1,2]. LECs offer a number of potential advantages, but there are some drawbacks such as phase separation between the apolar luminescent polymer and the strong polar PEO.

In this paper, bifunctional block copolymers were used to fabricate LECs in order to overcome the phase separation problem. The block copolymers, as shown in Figure 1, are composed of PPV segments with three phenylene vinylene units and PEO segments with three ethylene oxide units. The PPV segment is the luminescent conjugated unit. The copolymers were well compatible with PEO because of their flexible PEO segments.

The *I-V* and *L-V* characteristics of an ITO/**Polymer 2**+PEO(LiTf)/Al LEC under forward bias are shown in Fig. 2. The inset shows the *I-V* and *L-V* characteristics of an ITO/**Polymer 2**/Al LED. The threshold voltage for both current and light emission is 2.4 V in the LEC and no obvious hysteresis of light emission was observed. The light emission reaches a luminance of 8.3 cd/m<sup>2</sup> at 3.0 V. However, the turn on voltage is up to 12 V in the single layer LED and the brightness is 2.5 cd/m<sup>2</sup> at 15 V. The onset voltages of **Polymer 1** and **Polymer 3**- based LECs are 2.7 and 2.6 V, respectively.

The maximum EL efficiency for the LEC is ~0.74 cd/A at 2.8 V. It is much higher than that of the corresponding LED, which is ~0.013 cd/A at 15 V. EL spectra of the LECs based on the three copolymers show that the EL peak positions for all these polymers locate at 450~470 nm, indicating blue-green light emission in these devices.

**Acknowledgement** This work was supported by NSFC (No. 29992530-4, 69986001, 20004010).

### References

1. Q. Pei, G. Yu, C. Zhang, Y. Yang and A.J. Heeger, *Science* 269 (1995) 1086.
2. Q. Pei, Y. Yang, G. Yu, C. Zhang and A.J. Heeger, *J. Am. Chem. Soc.* 118 (1996) 3922.

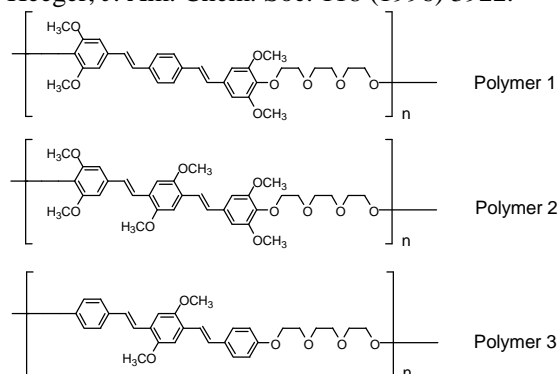


Fig. 1. Molecular structures of the block copolymers.

Fig. 2. Current-voltage and light-voltage characteristics of an ITO/**Polymer 2**+PEO(LiTf)/Al LEC device. The inset shows current-voltage and light-voltage curves of an ITO/**Polymer 2**/Al LED device.

