Optical characteristics of poly[(9, 9- dioctylfluorenyl-2, 7-diyl) – co – (1, 4- phenylene)] (F8P) on ITO coated glass

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Present work reports on the optical characteristics of light emitting polymers based on polyfluorene derivative (PFO). A layer of PFO known as F8P is coated on ITO/glass using spin coating method with toluene as the solvent. The thickness of the F8P layer is around 0.7 um as measured using scanning electron microscope (SEM). This thickness has been achieved with 150 s coating time and a maximum speed of 2000 rpm. Optical measurements using photoluminescence (PL) and Raman spectroscopy have been performed on the F8P layer. A prominent peak at 1605 cm^{-1} has been observed in the Raman spectrum and identified as due to the C=C molecular vibrations for F8P. For the PL, a dominant peak at 416 nm (violet) and a broad peak in the range of 470 and 540 nm (green) have been observed. The violet region is identified as from the polymer F8P, while the green region is due to the copolymer and humidity factor.

I. INTRODUCTION

Organic and polymer light emitting diodes (OLED/PLEDs) have become widely available and are used for replacing inorganic light emitting diodes as they are less expensive and provide many opportunities in regard to structural placement on application in displays [1].

Poly[(9,9- dioctylfluorenyl-2,7-diyl) – co – (1,4-phenylene)] (F8P) is a blue-green light emitting polymer which has great potential in display applications. This F8P is one of the families of polyfluorene's (PF) group, of which its light emitting mechanisms are not yet fully understood. In this work the optical characteristics of F8P on ITO coated glass have been investigated using SEM, PL and Raman spectroscopy.

II. MATERIAL AND METHODS

An ITO coated glass, which was cut into 1 cm × 1 cm × 1 mm is used as the growth substrate. A single layer of F8P was coated on the ITO/glass using spin coating method with toluene as the solvent. The coating time was set at 150 s and a maximum rotational speed of 2000 rpm. The sample was then annealed on a hot plate at 80°C for 15 minutes. PL and Raman measurements were performed using 325 nm and 514.5 nm excitation sources.

III. RESULTS AND DISCUSSION

Fig. 1 shows the SEM cross section micrograph of the F8P/ITO/glass structure. The average thickness of the F8P layer (the white top layer in Fig. 1) is estimated around 700 nm. The layer was found to be highly uniform and slightly bluish in color when observed directly by the naked eye.

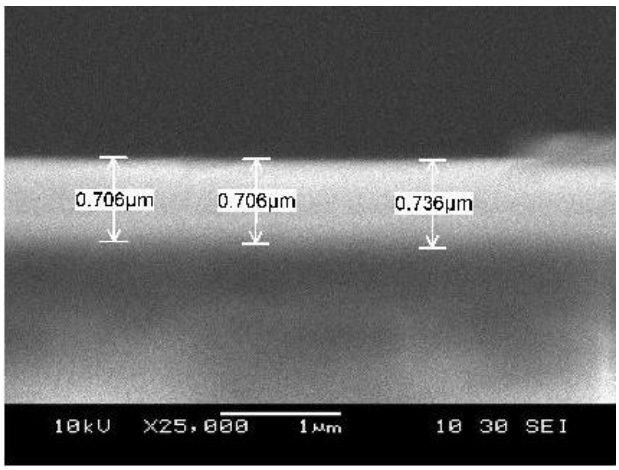

FIG. 1. SEM cross section of the F8P/ITO/glass.

Fig. 2 shows the Raman spectrum of the F8P layer. The dominant Raman peak at 1605 cm^{-1} is due the intra-ring C=C stretching mode. A weak peak at 1286 cm^{-1} originated from a combination of C-H bending and C=C stretching motion of the bond connecting the two phenyl rings within the monomer. It was observed that all F8P C-H Raman modes in the vicinity of 1100 cm^{-1} are sensitive to variations in annealing temperature. Such a mode is represented by the 1142cm^{-1} weak peak in Fig. 2. The peak is actually an indicator of defects that exist in the F8P due to variations in annealing temperature [2]. It is red shifted as the amount of defects is increased.

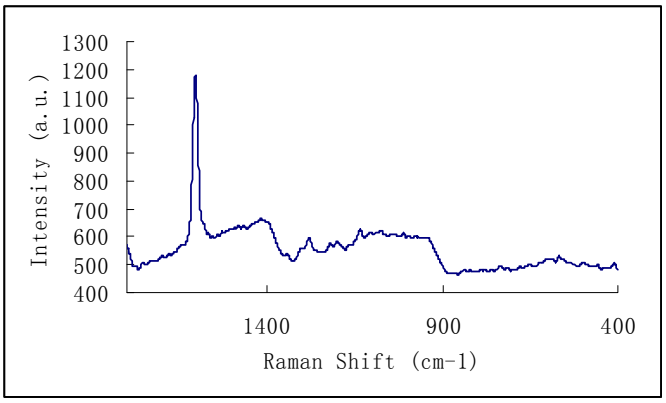

FIG. 2. Raman spectrum of F8P on ITO/glass.

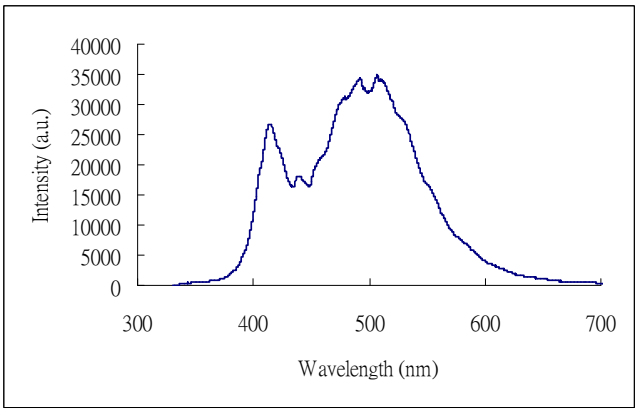

FIG. 3. Photoluminescence spectrum of F8P on ITO/glass.

Fig. 3 shows the PL emission spectrum of F8P thin film coated onto ITO/glass. The film has a strong PL emission in the violet region of the spectrum at 416 nm and a stronger broad PL emission in the range from 470 to 540 nm in the blue-green region. Interestingly, a weak peak exists between these two dominant peaks of which its origin will be further investigated. The strong broad emission in the blue-green region is associated to the copolymer and very much affected by environment factors such as humidity and solvent used for spin coating [3].

IV. CONCLUSION

We have performed optical measurements on F8P thin film grown on ITO/glass substrate. Violet and blue-green emissions have been observed from the PL measurement. Raman spectrum showed good quality and uniform F8P film as shown by the presence of a sharp and intense Raman peak, as confirmed by SEM cross section micrograph.

ACKNOWLEDGEMENTS

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