11th International Conference on Advanced Materials

ICAM2009

Rio de Janeiro Brazil
September 20 - 25

Integration of PLED Structures to Microchannel Arrays for Analytical Systems

T. Vidal*, G. O. Silva and L.F.Santos

Departamento de Física, IBILCE, Universidade Estadual Paulista – Campus São José do Rio Preto
e-mail: tabata@ibilce.unesp.br
* Corresponding author.

Abstract – Microchannel arrays, built on a poly(dimethylsiloxane) matrix, have been integrated to polymeric light-emitting diodes using poly(3,6-bis-(3,7-dimethyl octyloxy)-p-phenylene vinylene) as active layer for microfluidic analysis purposes. The microchannel structures were fabricated pouring the PDMS prepolymer onto a negative metallic master, with 20 µm resolution, and baking at 60°C for two hours. The detection system was comprised by a PLED in a ITO/PEDOT/OC10-PPV/Mg/Al structure coupled to the PDMS microchannel structure and an fiber optic spectrometer. The variation of the optical absorbance/emission spectrum has been used as detection means to quantify small concentration variation of different substances of interest in the microfluid. The integration of PLED structures to microfluidic devices offers compact and cost-effective alternative for applications in biological and chemical analysis.

The present work proposes the development of integrated microsystems comprising microfluidic arrays of poly(dimethylsiloxane) (PDMS) and polymer light-emiting diodes (PLEDs) to detect variations in the characteristic absorption and/or emission of biological or chemical substances. Polymeric optoelectronic devices are particularly suitable for such integration applications due to the ultra-thin, large-area characteristics and also due to the specific spectral band emission [1, 2].

The microchannel structures have been fabricated using moldable, highly transparent polymeric matrices, coupled to a glass substrate, and built onto a negative metallic master, previously fabricated by microphotolithography technique. The basic design of the micro-arrays structure is shown in Fig.1. A mixture (10:1 in mass) of PDMS prepolymer and curing agent (Sylgard 184, Dow Corning) was prepared, poured onto the master and cured for 2 h at 60 °C. Afterwards, the PDMS replica was separated from the master and top-covered by the PLED structure. The PLED devices were fabricated by deposition of a hole-transporting layer, consisting of 3,4-polyethylenedioxythiophene (PEDOT), and a OC10-PPV emitting layer, by spin coating, onto ITO-covered glass substrates. The device cathode was composed of a thin (20nm) Mg layer covered by a 100nm Al layer, both thermally deposited at high-vacuum conditions. An additional thin layer of PDMS was used to encapsulate the device. Current-voltage characteristics of the PLED and the optical transmittance/emission, measured by a fiber optics spectrometer, of the microfluidic system were monitored at different operation conditions in order to quantify the detection response of the analysis system.

The authors acknowledge the financial support from CNPq, Fundunesp, Fapesp and INEO Science Initiative (MCT/CNPq).

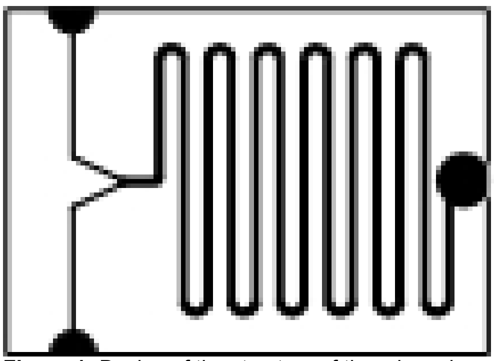

Figure 1: Design of the structure of the micro-channels.

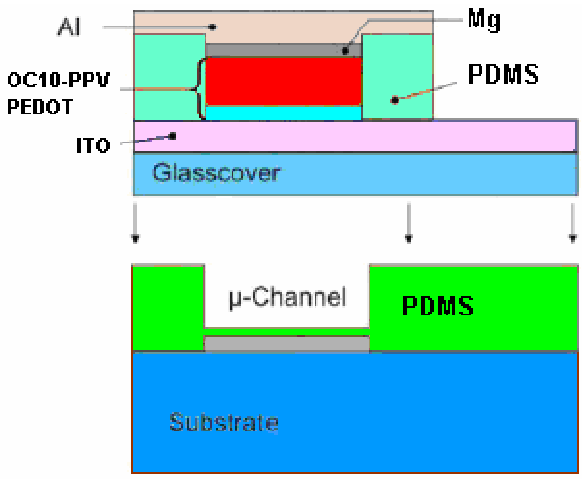

Figure 2: Integration of the PLED to the microchannel structure.

[1] L. Schöler, K. Seibel, K. Panczyk, and M. Böhm, *Microelectronic Engineering* **86** (2009) 1502-1504.
[2] D.C. Duffy, J.C. McDonald, O.J.A. Schueller, and G.M. Whitesides, *Analytical Chemistry* **70(23)** (1998) 4974-4984.