White OLEDs Based in a Simple Architecture with Exciplex Interface

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In this work, a new and simple OLED architecture enables to get good white CIE coordinates (0.29, 0.35) is presented. Two OLEDs architectures were tested, the first one was ITO / PEDOT: PSS / EML / PFN/ Ca-Ag (OLED-1) and the second ITO / PEDOT: PSS / EML / BPhen / Ca-Ag (OLED-2), where the copolymer Poly [(9,9-dioctylfluorenyl-2,7-diyl) -co- (N, N'-diphenyl) -N, N'-di (pbutylphenyl) -1,4-diamino-benzene)] was employed as the emissive layer (EML), the PEDOT: PSS was utilized as the hole transport layer (HTL) and the compounds PFN and BPhen as the electron transport layers (ETL). With OLED-1 the emission was blue light, due only at the emissive layer and with OLED-2 white light was obtained from the mixture of the EML and exciplex emissions. The turn-on of the devices was of 4 V and the maximum luminance was of 4100 cd/m2 at 7 V. We used ablation laser technique on the anode (ITO) to delimited the emission area. the area of as OLED was of 0.9 mm2. The lifetime of our devices with evaporate cathode (Ca-Ag) using T50 parameter (where the luminance decreases at 50%) was of 400 hours with encapsulating process while that OLEDs without encapsulated the lifetime was less of 30 hours. The laser ablation was used to delimit the OLED patters.

INTRODUCTION

Today, the performance of the white organic light emitting diodes WOLEDs has achieved power efficacy > 100 lm W^{-1} being a technology that in a short time will be able to compete with the inorganic LED and other traditional sources.

RAPID EFFICIENCY INCREASE IN WOLEDs

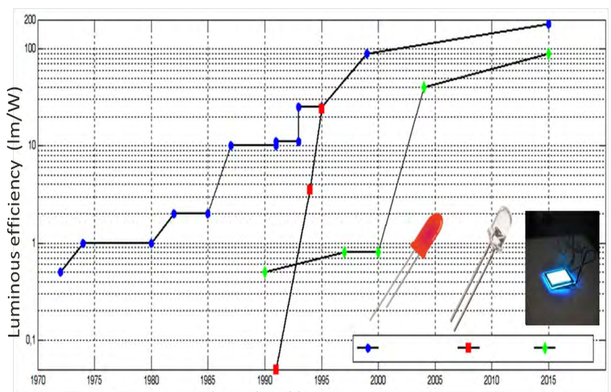


Fig 1. Rapid growth of efficiency in WOLED compared to inorganic LEDs.

White emission from WOLEDs, can be obtained, through the simultaneous emission of the three primary colors, red-green-blue, or by using two complementary blue-orange emissive materials. In contrast to multiple emitting layers, the WOLED with a single emitter layer can be made using exciplex states. For this matter, the white electroluminescence (EL) could emerge from excitons and other excited states that might emit at longer wavelengths.

In this work, white light was achieved by exciplex states. A first OLED device was made with PFN like electron injector layer (EIL). In this case, the electroluminescence was blue due only at the emission from the emissive layer. But in a second OLED architecture, the BPhen was used as EIL, which formed an energy barrier enough to induce the exciplex states and therefore white light was achieved.

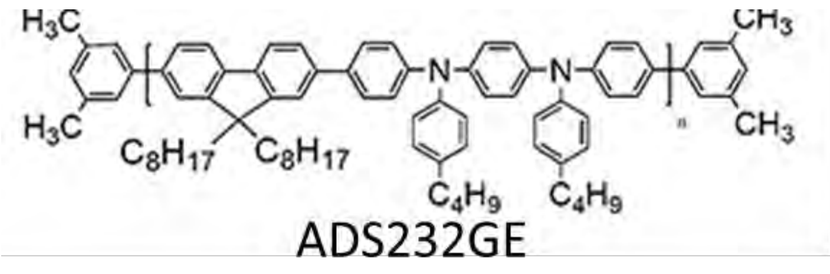


Fig.2. Chemical structures of the materials used like emissive layer (EML).

DESIGN OF THE DEVICES.

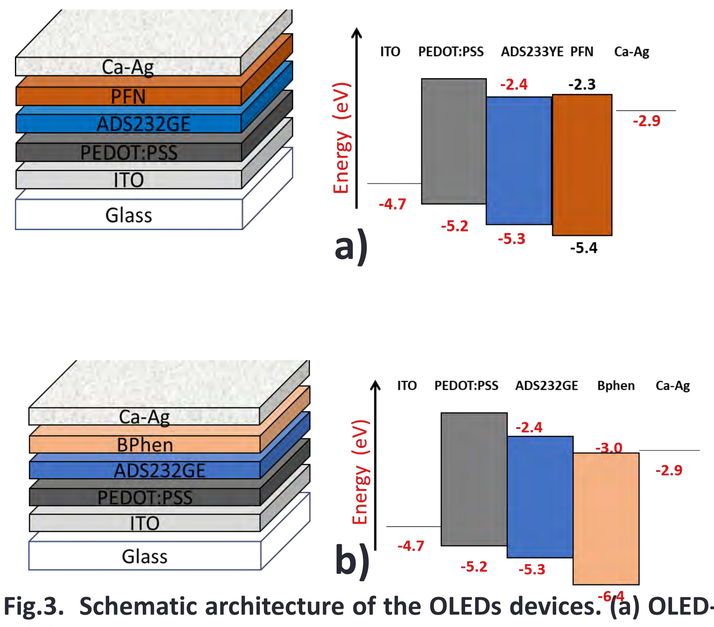


Fig.3. Schematic architecture of the OLEDs devices. (a) OLED-1 (b) OLED-2.

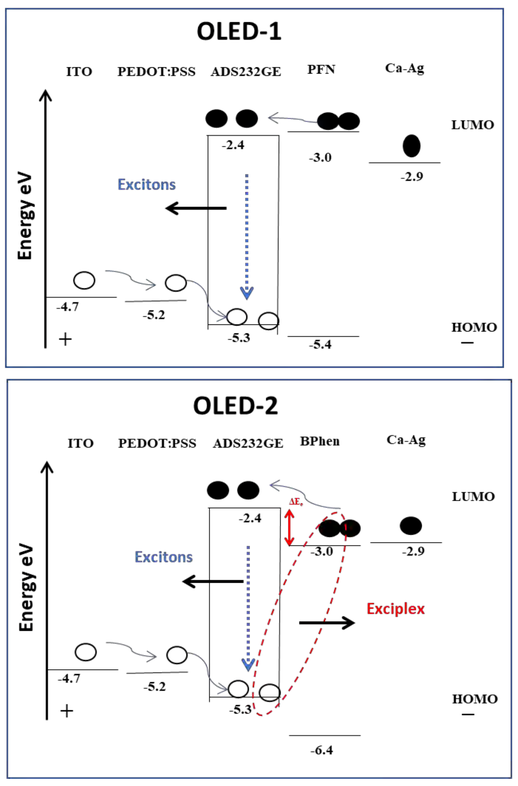


Fig.5. a) Scheme for the exciton and exciplex transitions to OLED-1 and OLED-2 devices.

RESULTS

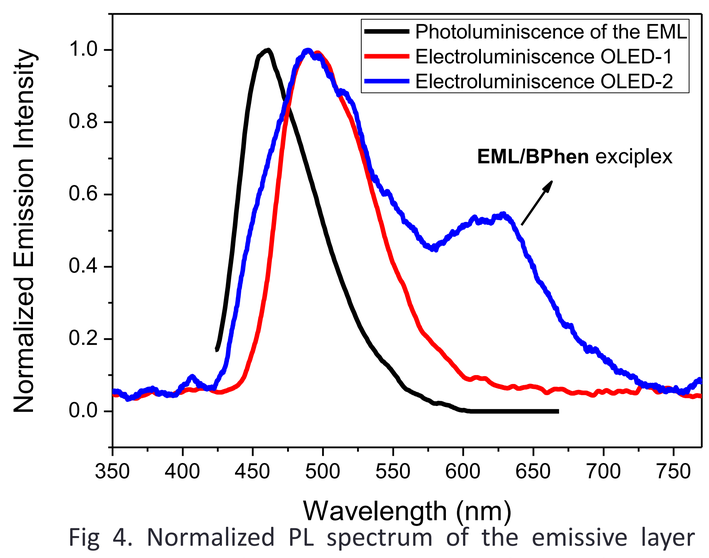


Fig 4. Normalized PL spectrum of the emissive layer and EL spectra for OLED-1 and OLED-2 (bias 7 V).

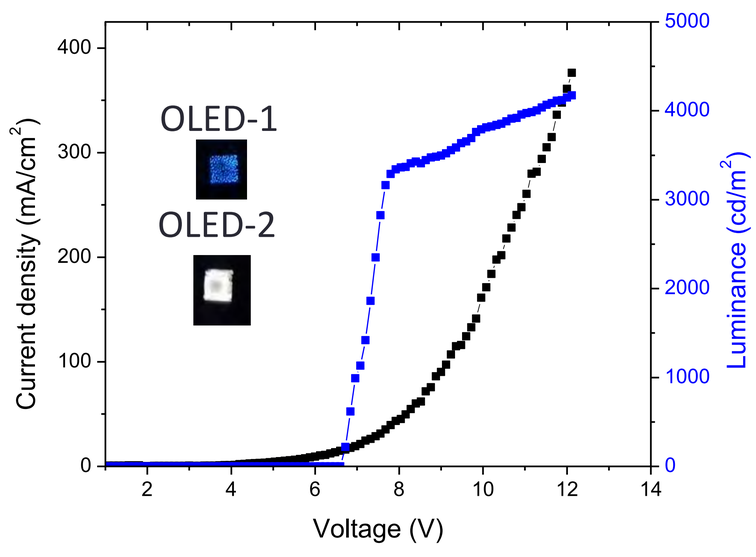
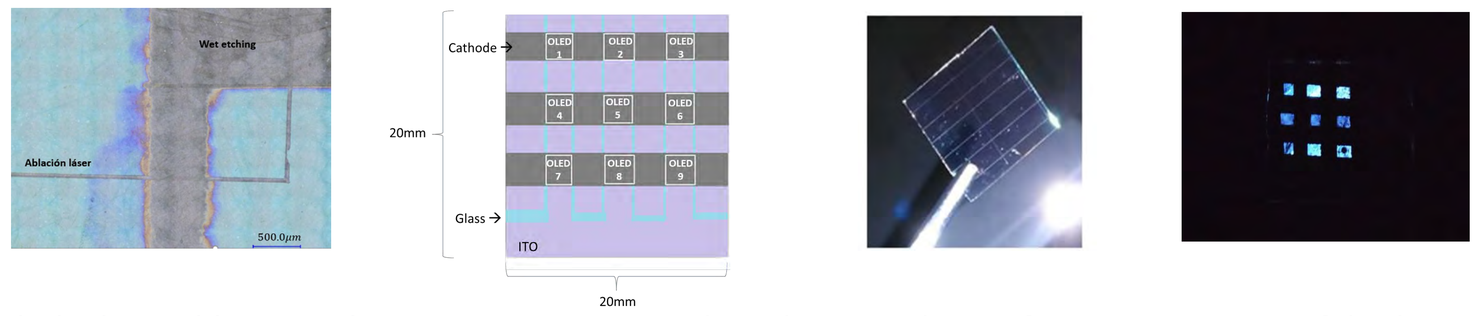


Fig.6. Curves J-V-L to OLED-2

LASER ABLATION TO WHITE OLEDS PATTERN DESIGN



With the laser ablation technique, our group intends to design and manufacture prototypes of displays and lighting sources using OLED matrix.

CONCLUSIONS

was possible to manufacture white OLEDs using a simple architecture and with acceptable optoelectronic parameters. In addition to the preliminary results, with the help of laser ablation, these simple OLED architectures could be used for prototypes of illumination and displays.

References
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