Printing of organic light emitting diodes on textile

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Abstract: Smart textiles with light-emitting properties open a whole new world of innovative textile applications such as indoor and outdoor design and safety clothing. To achieve light-emitting properties on textiles, organic light emitting diodes are printed or integrated onto textile substrates. The advantage of this approach is that typical textile properties like flexibility and drapabilty are maintained.

Keywords: smart textiles, OLED, printed electronics

Introduction

The future of smart or intelligent textiles with light-emitting properties is looking very bright. Besides the use as protective or safety clothing for road workers, police and fire departments, these light-emitting textiles can also be used as indoor and outdoor design. Lighting wallpaper or tiles and textile banners and flags used for advertisement are among this wide variety of applications. Even healthcare applications, such as light therapy are within reach.

To achieve light-emitting properties on textiles, organic light emitting diodes (OLEDs) are printed or integrated onto textile substrates [1]. These OLEDs are built up out of 4 to 6 very thin layers ending up with a device stack of maximum 0.5 micrometer and therefore maintain the flexibility and drapability of the textile substrate. Further they have a high brightness and very low power consumption. To protect these devices from fast degradation from contact with oxygen or water vapour, an encapsulation layer will be applied on top [2].

Results and Discussion

The roughness of most textile substrates is in the micrometer range, however the thickness of the different layers in the OLED stack and of the encapsulation layers are in the nanometer range. Firstly the influence of different smoothing layers, among which poly-urethane (PU), acrylate and polymethylmethacrylate (PMMA), are investigated. As a next step, encapsulation layers are applied using plasma techniques and their transparency, chemical composition and barrier properties for oxygen and water vapour are measured. On top of this encapsulation, the OLED stack is deposited. By using spin coating and evaporation techniques, OLEDs are fabricated and their resolving light output and luminous efficacy are measured. To finalize the complete stack, a last encapsulation is applied and the final properties of the device are measured and compared with reference devices on PET foil (figure 1) and glass substrates.

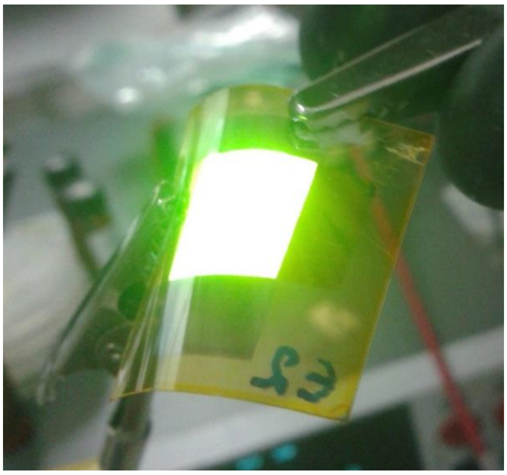

Figure 1: OLED printed on flexible PET foil

Conclusions

It is shown in this work that efficient OLEDs can be printed or integrated onto a textile carrier to be used in a wide range of applications.

References

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