The future in lighting

Vasileios Kyriazopoulos, OLEDs Production Department and Metrology Department at OET, provides an update on OLED technology and R2R production

Organic Light Emitting Diodes (OLEDs) are highly sought after for next generation display technology and solid state lighting, attracting much attention from both scientists and industry engineers due to their excellent properties. As OLEDs exhibit superior characteristics against their predecessor, LEDs, such as high luminous efficiency, full-colour capacity, high colour contrast, flexibility, wide viewing angles, low power consumption, light weight and especially printability, they are highly desirable for display and solid state lighting technologies.

Already, OLEDs have dominated the display market with screens in various sizes and resolutions and the lighting market is expected to follow the same path in the near future.

Roll-to-roll pilot production line at the COPE-H and OET facilities

R2R OLED production

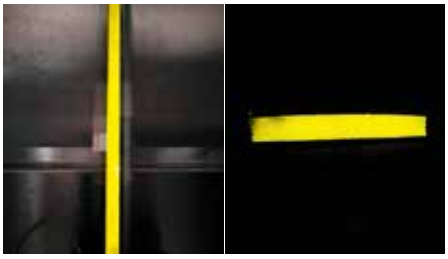
Currently, the main technology for OLED displays and lighting applications is the vacuum technique, with which very highly efficient OLED displays and lighting panels can be produced that also feature excellent stability.

Vacuum technique provides the advantage of being able to fabricate complex OLED structures, maximising the potential of organic materials, but in turn makes the whole process more difficult resulting in increased manufacturing costs, which is eventually incorporated into the final product price. In this respect, the most attractive attribute of OLEDs turns out to be their fabrication through solution processes, which make the whole process simpler and less expensive and at the same time enable the fabrication onto a flexible substrate.

Solution-processed OLEDs can be easily manufactured by modern 'roll-to-roll' compatible wet-processing techniques, e.g. slot-die, screen printing and ink-jet printing coating methods, into complex designs and shapes, suitable for lighting applications.

Unique properties:

- Very good efficiency and stability
- Light and thin
- Flexible and conformable
- Simple structure & fabrication
- Low fabrication cost
- Low fabrication energy consumption



Printed OLED stripes produced by the R2R PPL

Organic Electronic Technologies P.C (OET), a high-tech SME located in Thessaloniki, Greece, being a pioneer in the manufacturing of organic electronics, has acquired the fundamental knowledge in processing OLED materials with various wet coating techniques and paves the way for large-scale production of the future lighting and automotive applications.

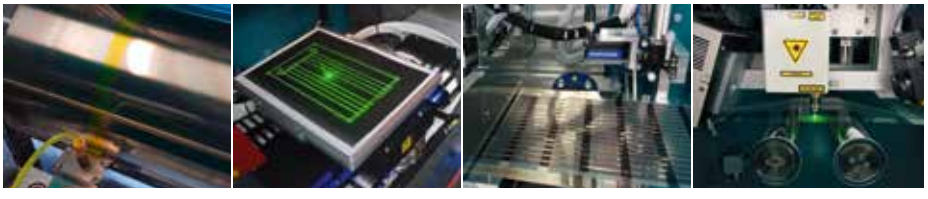
OET has open access to the unique roll-to-roll (R2R) pilot production line (PPL) of the nanotechnology lab LTFN of the Aristotle University of Thessaloniki (AUTh) at the COPE-H facilities, which is equipped with many state-of-the-art printing and metrology tools, such as slot-die coating and ink-jet printing stations, spectroscopic ellipsometry (SE) and Raman spectroscopy (RS) in-line quality control tools and pulsed laser scribing systems, among others.On one hand, the printing of successive organic layers, one after the other enables the reduction of production time, while the low material consumption of the expensive organic materials turns down the production cost. Also, by utilising the unique in-line and real-time quality control tools of the R2R line the reproducibility and reliability of the printed OLEDs is achieved, making the large scale production of printed OLEDs affordable for everyday life applications.

OET, taking advantage of the flexible and bendable nature of printed OLEDs, has already developed several demonstration applications and aims at large-area mass production of consumer products for lighting, packaging and signalling.

Pooling resources

The innovation is supported by the actions of the EU-funded H2020 project SmartLine ("Smart in-line metrology and control for boosting the yield and quality of high-volume manufacturing of Organic Electronics"), CORNET ("Multiscale modelling and characterisation to optimise the manufacturing processes of Organic Electronics materials and devices") and RealNano ("In-line and Real-time digital nano-characterisation technologies for the high yield manufacturing of Flexible Organic Electronics") and the national project Apollon ("Printed OLEDS for intelligent, efficient & tunable solid-state lighting devices in Large Scale) which are tackling the issue of Organic Electronic manufacturing and enhance the development of a "unique EU Open Innovation Environment (OIE)" covering the triangle of manufacturing, modelling and experimentation.

Written by Vasileios Kyriazopoulos, OLEDs Production Department of OET P.C.
Image sources: OET



From left: Slot-die coating process, pulsed laser scribing system, inkjet printing process, in-house developed spectroscopic ellipsometry and Raman spectroscopy in-line quality control tools