Slot Die Coating of OLED-Multilayers

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Organic electronics such as organic light emitting diodes (OLEDs) consist of several functional layers. The thickness of one single layer is in the range of 5 to 200 nanometers. State of the art is that such thin layers are deposited by vacuum evaporation and not by liquid deposition. Large area coating technologies with high reliability need to be developed to lower the prices of organic electronics [1]. High precision liquid film coating technologies are needed in order to coat such nanometer thick layers with an acceptable homogeneity. The biggest challenge for solution processing of organic electronics is to realize the multilayer architecture. The research in liquid film coating of organic electronics mainly sets priorities on increasing the efficiency of the devices whereas the process, its scalability and stability are often neglected [2]. Most work of solution processed organic electronics is currently done by spin coating.

In this work we investigate slot die coating for solution processing of a simplified small molecule OLED stack, consisting of two or three organic layers, shown in figure 1.

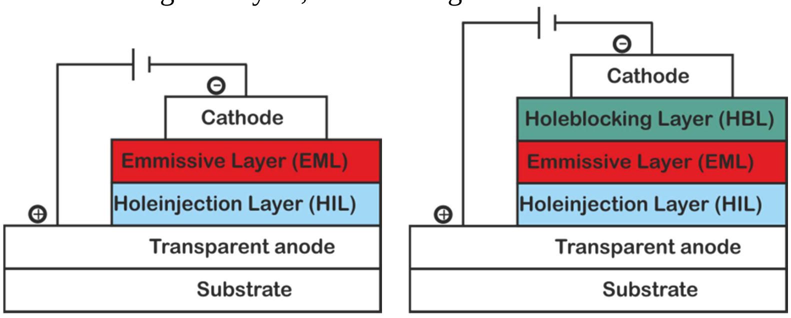

Figure 1.1 (left): OLED-Stack with two organic layers; Figure 1.2 (right): OLED-Stack with three organic layers.

All experiments are performed in batch-wise coatings on a structured ITO anode. Besides a step by step coating, meaning the single layers are coated from orthogonal solvents after the underlying layer is dry, a simultaneous coating of two layers is investigated as well. The metal cathode is evaporated after coating of the organic layers. Device data is measured to analyze the influence of coating and drying parameter as well as coating solution composition on the device efficiency. The size of the measured OLEDs is 6 x 3 mm² for small and 14 x 14 mm² for larger pixels (figure 2).

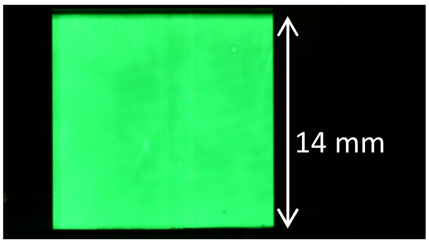

Figure 2: OLED with two solution processed layers (HIL and EML).

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