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Combinatorial method for materials screening and device optimization of thin layer opto-electronic devices[1]

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A rapid materials screening and a combinatorial development of thin film multilayer electro-optical devices is essential for a fast research and development progress and the implementation of device structures into commercial products. A well-established and reliable film preparation technique within the required nanometer film thickness range is the vapor deposition. The presented combinatorial methods are based on the preparation of linear or steps gradient and the preparation of sectors of material combinations or device structures by using mask movements in combination with a substrate positioning. Both of the two principles are combined to obtain an infinite number of possible libraries with different complexity, which may differ in each sector by the layer thickness, the sequence of layers, and the material selection. In addition by simultaneous evaporation using two or more sources and varying the deposition rate material compositions can also be created. In this presentation we represent an overview of our work on the combinatorial material screening and combinatorial optimization of multilayer thin film organic electro-optical devices prepared by vapor deposition. This article covers results on organic light emitting devices (OLEDs), organic solar cells, the orientation behavior of formanisotropic functional molecules on alignment layers, and the in-situ preparation and orientation of rod like and thermally stable aromatic polyimides.

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