Monolithic integration of organic optoelectronic devices and application

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Significant progresses have been made in the development of functional organic devices for application in organic light-emitting diode (OLED) displays, white OLED lighting, organic transistors, organic photodetectors (OPDs), and organic solar cells. The emerging organic electronic devices offer additional advantages such as large area, flexibility and solution-based fabrication process at low cost. In this work, we discuss the results of a proximity sensor based on the monolithic integration of an OLED and an OPD. This sensor technology provides functional superiority for a broad range of applications. The design and fabrication flexibility provided by the material and process could readily construct multilayered organic optoelectronic systems with potential for application in finger print identification, image scanner, position scanner, and compact information systems.

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The operation principle of the integrated sensors is that the emission from the OLED component can pass through the transparent substrate and then reflected back by the objects. The reflected light can then be captured by the OPD compoment in the sensors. Depending on the reflectivity of the samples, the intensity of the reflected light is a function of the reflectivity of the objects, that can be calibrated through analyzing the spectral response of the OPD units in the sensors. The efficient operation of the integrated sensors requires that a high extraction of light emitted by the integrated OLED unit to maximize the emission output and a high spectral responsitivity of the OPD components in the sensor, thereby to increase the signal to noise ratio (SNR). The frequency response and the SNR of the integrated sensors are optimized through theoretical simulation and experimental optimization. The sensor device having different photo-responses to various types of surfaces, for example, different colored papers and metal foils, are demonstrated.