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The use of a thermal-head inkjet printer to produce films of PEDOT and PAni

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Abstract: PEDOT and PAni films were printed using a thermal-head inkjet printer. Electrical characterization of PANI and PEDOT films printed on glossy paper was perfomed. The sheet resistivity shows a typical value of 35 kΩ/□, 40 MΩ/□ for doped and undoped PAni respectively. Our results show the viability to produce all-organic sensors using PEDOT as electrode and PAni as sensing material.

Polyaniline (PAni) and poly(3,4-ethylenedioxyothiophene) (PEDOT) are probably the most studied conductive polymers. PEDOT is very interesting because of its transparency, high electric conductivity, and it has been widely used as electrode in photovoltaic devices and sensors. PAni is frequently employed because it has a good environmental stability, is easy to synthesize and doping/dedoping process is reversible. Ammonia (NH_3) is a toxic gas, highly hydro soluble [1,2] and due to strict rules on the level tolerance of exposure to ammonia [3] high sensitivity sensors are required. The polymer PAni is one the good candidate since ammonia reacts with nitrogen atoms of PAni changing its electric conductivity [4]. Several authors have reported that "printing" of PAni on flexible substrates [5] can be achieved using piezoelectric-head inkjet printer. In this work we show that PEDOT and PANI can be "printed" using a commercial thermal-head inkjet printer aiming to built all-organic sensor. The PEDOT "ink" was obtained by diluting in water 1:1(V/V) the commercial poly(3,4-ethylene dioxythiophene):poly(styrene sulfonate) (PEDOT:PSS). To prepare the PAni "ink", first the PAni powder was dissolved in N-methyl-pyrrolidinone (20 mg/ml) and then water was added in the proportion of 3:7(V/V). Optical microscopy images show that the printed films have a quality that depends on substrates, number of printed layers and on the line width of the desired patterning. AC and DC electrical characterization of PAni and PEDOT films printed on different substrates were performed. For example, film resistivities for ten layer of PEDOT and PAni printed (undoped) on glossy paper were respectively 60kΩ/□ and 40MΩ/□ smaller than ~55 MΩ/□ found for glossy paper. It is worth to mention that after the PAni layer had been doped in HCL vapour its resistivity decrease to 35kΩ/□ in agreement with published values. To conclude, we confirmed in this work that is possible to use thermal-head inkjet printers to print PEDOT and PAni with different patterning . We believe that all-organic sensors could be fabricated using PEDOT layers as electrodes ad PAni as sensing material to detect ammonia.

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