

Figure 2: The silver nanoparticle electrode on the multilayered OEET after exposure to electrolyte and degrading. The silver nanoparticle ink has been removed between the PEDOT:PSS layer (left) and the polyimide layer (right).

layers of PEDOT:PSS ink were printed and annealed for five minutes on a hotplate at 120°C.

The planar all-PEDOT:PSS OEET was printed in one step with four layers. The PEDOT:PSS was then annealed using a hot plate at 150°C for two hours.

Electrical testing was performed on each device using probe station and phosphate buffered saline (PBS) as the electrolyte.

Results and Conclusions:

It was found that the PEDOT:PSS ink would not spread adequately on the Parylene-C surface to print a successful pattern; the Parylene-C was too hydrophobic to allow for the ink to spread. To make the Parylene-C more hydrophilic, each slide was treated with a 30 second O₂ plasma treatment. With this, the surface energy of the Parylene-C was adequately changed to allow for printing of PEDOT:PSS.

The optimized parameters for polyimide and silver ink could be varied significantly and still print successfully; however, a drop spacing of 23 μm and a substrate temperature of 35°C gave the most accurate printed pattern for both inks. PEDOT:PSS, when printed on plasma treated Parylene-C, was most effectively printed at a drop spacing of 23 μm and a substrate temperature of 28°C.

Both OEET designs were successful transistors. However, due to inadequate annealing of the silver nanoparticle ink in

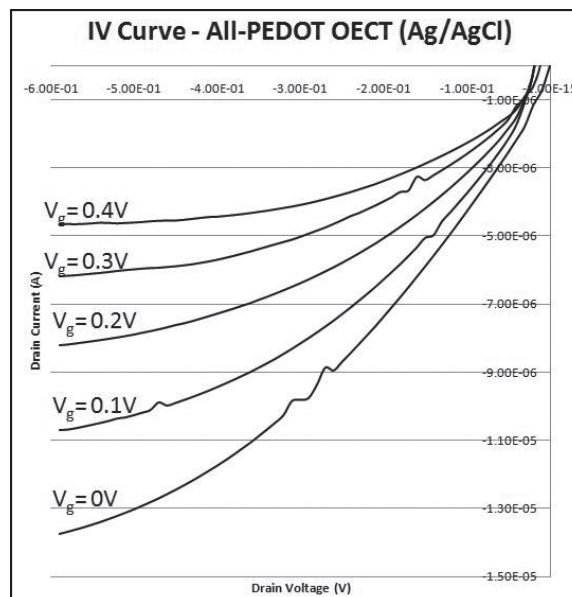


Figure 3: Current vs. voltage graph for all-PEDOT OEET using an Ag-AgCl gate electrode. The gate voltage (V_g) is applied between 0.0V and 0.4 V at 0.1V intervals.

the multilayered device, the OEET failed in electrolyte and detailed electrical characterization could not be performed. The picture in Figure 2 shows the degradation of the silver nanoparticle electrode after exposure to electrolyte. Nevertheless, the all-PEDOT:PSS OEET was successfully tested using PBS electrolyte and a probe station with a Ag/AgCl gate electrode. According to the data in Figure 3, as the gate voltage was increased, the drain current was decreased.

In conclusion, all-PEDOT:PSS OEET were fabricated using inkjet printing techniques on a biocompatible substrate (Parylene-C). It showed regular ion-to-electron converter behavior and is suitable for biosensing applications.

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