CHARACTERIZATION OF AN OTFT-BASED BIOSENSOR USING A TIPS-PEN COMPOSITE WITH ATMOSPHERIC PLASMA-TREATMENT*

Hong Goo Jeon, Chan Youn Cho, Young Chan Kim, Jin Sung Choi, Y. K. Kim, E. H. Choi and Byoungchoo Park

Department of Electrophysics, Kwangwoon University, 447-1 Wallgye-Dong, Nowon-Gu, Seoul 139-701 Korea

Solution-processable organic semiconductors have been investigated for flexible biosensors. In this study, we report the design and fabrication of biosensors based on organic thin-film transistors (OTFTs). The organic semiconductor thin films were composed of a small molecular 6,13-bis(trisopropylsilylethynyl)-pentacene (TIPS-PEN) composite blended with a polymer binder of poly(a-methylstyrene) (PaMS), which had been exposed to atmospheric pressure (AP) plasma. To create a dense structure and find the optimum condition of the electric property, the OTFTs were annealed at various temperatures for 1 h under N₂ gas. The relationship between the resistive change and the binding of bio-moieties in the TIPS-PEN layer is observed in the output and on/off characteristics of the OTFTs. In the I-D-V_G curves of OTFTs measured after exposure to a DNA containing solution in comparison with the AP plasma. The exposure of the OTFTs to DNA material causes a lowering of I_D at V_D = -60 V and V_G = -60 V of nearly 90% of magnitude. All these results indicate that the use of OTFT sensing could facilitate the detection of extremely small variations in plasma-treated TIPS-PEN due to exposure of biomaterial. The detailed experimental results of the OTFT analysis as well as the adsorption of the DNA material will be presented.

* Work supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) grant funded by the Korea government (MEST) (2011-0000848).