Contact resistance in Pentacene based organic thin-film transistors.

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Abstract

Unlike silicon based field-effect transistors, contact properties between source/drain electrode and organic semiconductor layer in organic thin-film transistors (OTFTs) are not easily optimized by conventional progress, such as doping or metal alloying. Especially, the performance of OTFTs is influenced by geometrical or extrinsic factors. Among these factors, contact resistance between source/drain electrodes and organic semiconductor layer is one of the critical parameters for the performance of OTFTs and systematic investigations are recently reported by some groups. In this article, contact resistance was extracted by fabricating top contact structure OTFTs with various channel length. For the fabrication of OTFTs, pentacene was used for active layer and Au, as source and drain electrodes, was deposited using Nickel-electro plating mask with 10, 20, 40, 60, 80, 100㎛ as channel length. According to our experimental results, contact resistance was measured about $10^6 \sim 10^{10}\ \Omega$ (shown Fig. 1) and tends to significant dependence on the gate bias (shown Fig. 2). We expect that these results can be used for physical analysis and equivalent modeling for OTFTs and also help to fabricate devices with better performance. Furthermore, based on our previous study, systematic investigations into relationship between contact resistance and deposition rate of Au, for source/drain contacts is under investigation, which is expected to help to understand physical properties of interface between source/drain electrodes and organic semiconductor layer.

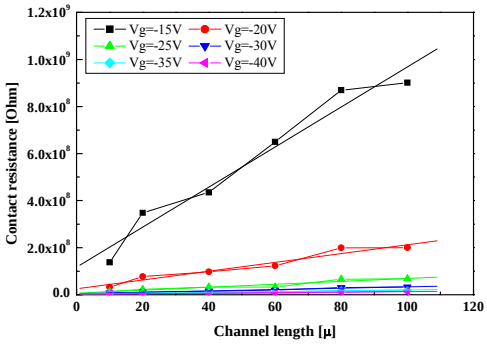

Figure 1. Extracted contact resistance

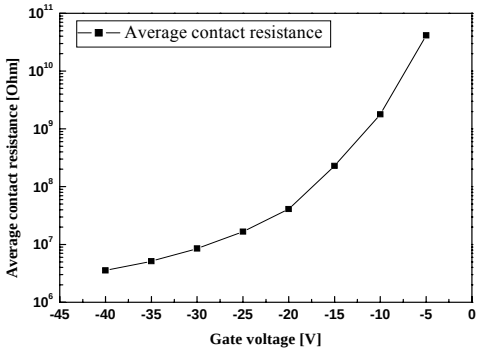

Figure 2. Contact resistance depends on gate bias