Enhanced Penformance of Bottom-Contact Organic Field-Effect Transistors with M(DMDCNQI)$_2$ Buffer Layers

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We demonstrate enhanced mobility and reduced contact resistance in bottom-contact organic field-effect transistors (OFETs) based on pentacene and low-cost metal electrode such as Ag and Cu. It is well known that these low work-function metals result in poor performance because of the large contact resistance. It has been reported that 7,7,8,8-tetracyanoquinodimethane (TCNQ) modification of metal electrode can reduce contact resistance and the performance is improved [1].

In this study, enhanced performance is achieved by introducing a metal dimethyldicyanoquininediimine (DMDCNQI) buffer layer at the source-drain electrode/semiconductor interface. After the fabrication of metal electrodes, the substrates were dipped in an acetonitrile solution of DMDCNQI for 10 min. DMDCNQI easily reacts with Ag and Cu to form high-conductive charge-transfer complexes [2], which work as buffer layer. The hole mobilitiies of pentacene based OFETs are enhanced significantly. In the case of Ag electrode, the mobility is improved from 0.0014 cm^2/Vs to 0.22 cm^2/Vs (Figure), which is comparable to the Au top-contact OFETs fabricated under the same conditions.

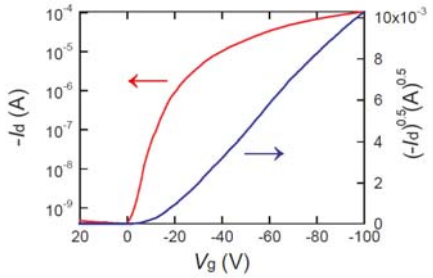

Figure Transfer characteristics of the pentacene based OFET with DMDCNQI-treated Ag electrode.
(W = 1000 μm ; L = 100 μm)

[1] C. Di *et al.*, J. Am. Chem. Soc., 128 (2006) 16418.
[2] H. Wada *et al.*, J. Mater. Chem., 18 (2008) 4165.