World Academy of Science, Engineering and Technology
International Journal of Electronics and Communication Engineering
Vol:12, No:10, 2018

Estimation of Mobility Parameters and Threshold Voltage of an Organic Thin Film Transistor Using an Asymmetric Capacitive Test Structure

Authors : Rajesh Agarwal

Abstract : Carrier mobility at the organic/insulator interface is essential to the performance of organic thin film transistors (OTFT). The present work describes estimation of field dependent mobility (FDM) parameters and the threshold voltage of an OTFT using a simple, easy to fabricate two terminal asymmetric capacitive test structure using admittance measurements. Conventionally, transfer characteristics are used to estimate the threshold voltage in an OTFT with field independent mobility (FIDM). Yet, this technique breaks down to give accurate results for devices with high contact resistance and having field dependent mobility. In this work, a new technique is presented for characterization of long channel organic capacitor (LCOC). The proposed technique helps in the accurate estimation of mobility enhancement factor (γ), the threshold voltage (V_th) and band mobility (μ_0) using capacitance-voltage (C-V) measurement in OTFT. This technique also helps to get rid of making short channel OTFT or metal-insulator-metal (MIM) structures for making C-V measurements. To understand the behavior of devices and ease of analysis, transmission line compact model is developed. The 2-D numerical simulation was carried out to illustrate the correctness of the model. Results show that proposed technique estimates device parameters accurately even in the presence of contact resistance and field dependent mobility. Pentacene/Poly (4-vinyl phenol) based top contact bottom-gate OTFT's are fabricated to illustrate the operation and advantages of the proposed technique. Small signal of frequency varying from 1 kHz to 5 kHz and gate potential ranging from +40 V to -40 V have been applied to the devices for measurement.

Keywords : capacitance, mobility, organic, thin film transistor
Conference Title : ICOEP 2018 : International Conference on Organic Electronics and Photonics
Conference Location : Sydney, Australia
Conference Dates : October 04-05, 2018