

Effects Of Chemical Environment On Organic Electronics

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Organic electronics is a new technological area that attracts great deal of attention. It is generally known that ambient environment can affect organic electronics, but not enough attention has been paid to this point. One of the most interested organic electronics is organic semiconductor (OS). The presence of chemical species in ambient environment can have both, reversible and irreversible, effects on devices made from OS, that could be either beneficial or detrimental. It is important to understand and control those chemical environmental factors. The objective of this presentation is to discuss origin and influence of those effects.

Controlled interactions between the chemical environment and solid state devices have been well documented and utilized in chemical sensors. On the other hand, uncontrolled chemical interactions with a solid state device may lead to experimental artifacts in electronics that is intended for signal and information processing.

A general four terminal silicon-based test platform has been made to test those effects (Fig.1)¹ using different conducting polymers. The test platform can be operated in either Insulated Gate Field-Effect Transistor (IGFET) mode or Organic Field-Effect Transistor (OFET) mode. A comparison of performance has been made between these two modes. The goal of interaction studies between ambient chemical species and OS includes: monitoring changes in work function (WF) and conductivity of the applied OS material, chemically induced changes of barriers at the metal/OS junctions and the effect of absorbed species on the interface between the OS and the dielectric substrate.

Controlled experiments were performed with different organic semiconductors by exposing them to different interfering chemical species including: water moisture and oxygen. Also volatile compounds with different electron affinity are being tested in order to understand the causes of those observed changes in the stability of the devices. The different origins of interactions will be discussed.

It is important to understand and control those chemical environmental factors. Failure to do so may result in experimental artifacts, misinterpretation and in incorrect allocation of developmental resources. And it is particularly important in organic electronics in which OS are subjected to high applied voltages that are close to the breakdown limits of many materials and structures.

Acknowledgments

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Reference:

- (1) L'Hereec, F.; Chen, H.; Zhou, Z.; Janata, J.
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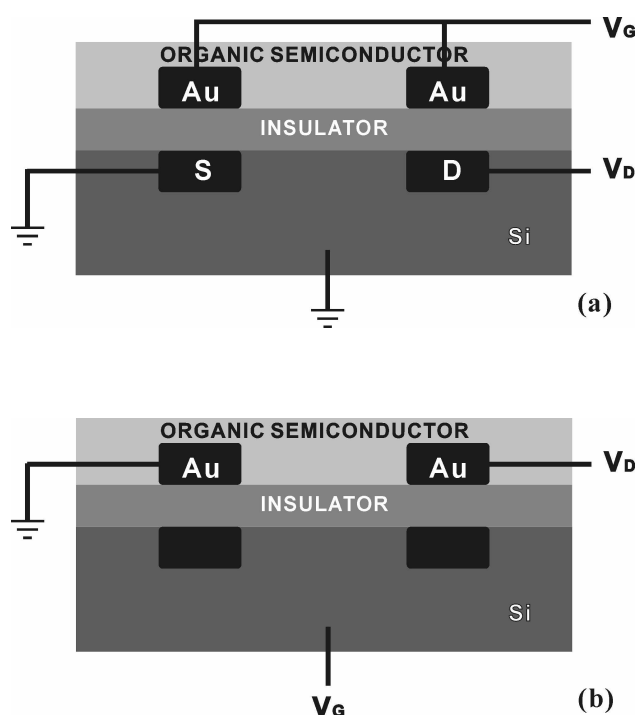


Fig. 1 Schematic of IGFET/OFET platform operated in (a) IGFET mode and (b) OFET mode