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Highly sensitive and selective gas sensor utilising tips pentacene based organic thin film transistor

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Organic sensing technology has been widely investigated in the last few years. The low fabrication cost, high sensitivity, short response and recovery time allowed this type of sensors to dominate the research activities in academia and industry. In this work, solution processed organic thin film transistors (OTFTs) based on 6,13-bis(triisopropylsilylethynyl) (TIPS) pentacene were fabricated and characterized using the bottom-gate, top-contact (B-G, T-C) configuration. After preparing clean glass substrate, a 50nm aluminium was thermally evaporated as the gate electrode. The insulating layer was spin coated (2000 rpm) from a cross-linked polymethyl methacrylate (cPMMA) 5% anisole solution by using [1,6-bis(trichlorosilyl) hexane (C6-Si) (10µ/1ml) as a cross-linking agent to produce 330nm layer thick. Tips-pentacene semiconductor (2% toluene solution) was drop coasted on the cPMMA layer as the active layer. Finally, gold electrodes of 50nm thickness were thermally evaporated on the TIPS-pentacene active layer to provide the drain and source. After exposing the OTFTs to different concentrations of ethanol vapour, the current-voltage characteristics of the OTFT sensor and the response to different concentrations of ethanol (from 1ppm to 8ppm) were investigated. The output characteristics (VDS = 0 – (-60) V) with different gate voltages (VGS= 0 – (-50) V) and different ethanol concentration were investigated. It was found that the drain source current in the saturation region decreases rapidly when the OTFT was exposed to ethanol vapour at room temperature (~25 Co). Furthermore, the transfer characteristics with different ethanol concentrations showed a clear shift in the threshold voltage, which increased (from -2V to -18 V) with increasing the ethanol concentration.

Therefore, the source drain current in the TIPS pentacene based OTFTs can be considered as a significant parameter to monitor chemical species and it can be used as a sensor for chemical gases.

Speaker Biography

Amjad Al Shawi is a PhD student at the school of electronic engineering, Bangor University, UK. He is in his third year of the PhD in the field of organic transistors and organic memory devices. He completed his B.Sc. and M.Sc. study in physics from Basra University, Iraq. He also worked as a researcher in the Polymer Research Centre at Basra University, Iraq.

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