

Pharmaceutics & Novel Drug Delivery Systems

21st International Conference on

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Advanced Nanoscience and Nanotechnology

June 21-22, 2018 | London, UK

Graphene oxide-based organic memory transistors

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In this work, graphene oxide-based organic memory transistors were fabricated and characterized. Graphene oxide (GO) was used as the floating gate in all organic memory transistors. A cross-linked Polymethyl methacrylate (cPMMA) was used as the insulating layer, while TIPS-pentacene was used as the semiconductor. The gate electrode was fabricated from aluminum by thermally evaporation of a 50 nm film on a clean glass substrate, while the drain and source have been made by evaporating 50 nm of gold. After cleaning the glass substrate, insulating layer of 330 nm cPMMA was spin-coated with a spin speed of 2000 rpm. Drop-casting method was applied to produce a thin layer of TIPS-pentacene semiconductor (3% toluene solution). For the floating gate nanoparticle, a thin layer of graphene oxide (4mg/ml water dispersion) was spin-coated with a spin speed of 3500 rpm. The reference control transistor devices (without floating gate nanoparticle) were also fabricated with the same conditions. The electrical properties of the control transistor showed no or negligible hysteresis with very clear current-voltage (I-V) behavior. On the other hand, memory transistors showed high hysteresis and memory

window which is increasing with increasing programming voltage. Adding nanoparticles as a floating gate results in such hysteresis which is considered to be from charging and discharging these nanoparticles with the applied programming voltage. The counter-clockwise direction of hysteresis is a clear indication that the nanoparticles floating gate can be charged through the semiconductor surface. To investigate the threshold voltage shift, different voltages pulses were applied to the gate resulting in a clear shift in the threshold voltage and it increased by increasing the pulse voltage. In addition, the charge retention was studied and it was shown that all the devices have non-volatile behavior.

Speaker Biography

Amjad Alshawi 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 worked as a researcher in the polymer research center at Basra University.

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