Solution-processed electronics: Low-voltage organic transistors (OFETs)

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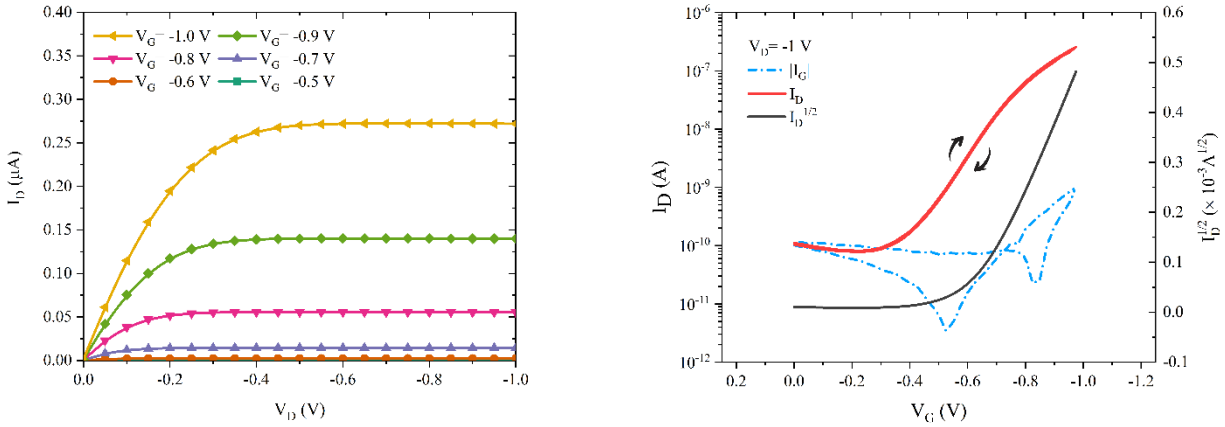
Organic field-effect transistors (OFETs) are key components of low-cost, flexible and large area electronics. Extensive research has focused on the development of solution-processed, high mobility organic semiconductors for these devices, but recently the gate dielectric has attracted significant interest as the development of high dielectric constant (high-κ) materials opens the path for enabling low voltage operating OFETs.

In this talk, the physics, operation and the performance of OFETs using solution-deposited high-κ Ta_2O_5 will be covered. It is shown that the optimized OFETs using p-type high mobility solution-processed semiconductor, poly(3,6-di(2-thien-5-yl)-2,5-di(2-octyldodecyl)-pyrrolo[3,4-c]pyrrole-1,4-dione)thieno[3,2-b]thiophene) (DPPDTT) blended with poly(methyl methacrylate) (PMMA) with 7:3 ratio operate at gate voltages as low as 1 V with minimal hysteresis and posess low subthreshold slopes (<120 mV/dec) and hole mobilities around 0.22 cm^2/Vs. Solution-processed Ta_2O_5 emerges as a promising candidate for the fabrication of low voltage OFETs for use in aqueous-based biosensors and low power electronics.



(a) (b)

Fig.1. (a) Output and (b) transfer characteristics of the proposed low voltage ODTS-treated Ta_2O_5 OFETs: PDPPTT/PMMA blend as the active layer.