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CHARACTERIZATION AND MODELLING OF ORGANIC FIELD EFFECT TRANSISTORS BASED ON TERRYLENE THIN FILMS

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A field effect transistor has been used to study the transport properties of a oligomer of poly(peri-naphthalene), the terrylene. His molecular structure intermediate between polyacetylene and graphite, may result in a large overlap of the orbitals with neighbouring molecules, therefore it is expected to have excellent structural stability and high carrier mobility. A study of the FET characteristics reveals a mobility of (10-5 cm2/Vs). This is due to a large concentration of deep traps in the accumulation channel. In order to provide direct evidence for the presence of these traps, three different measurement techniques were used for the first time in organic transistors: (i) deep level transient spectroscopy, (ii) field effect conductance technique, and (iii) thermally stimulated currents. The application of these techniques to organic transistors requires a particular device design, attention to the effects of hysteresis and bias induced stress. The results show that it is possible to obtain quantitative information about traps in the FET channel. This information was used to interpret the temperature dependence of the mobility and threshold voltage. Studies of ageing shows that terrylene-based transistors are environmentally more stable than those of other conjugated organic materials. Finally, we report on modelling of direct current characteristics.