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Low-Temperature Structural Phase Transition in a Soluble Oligoacene and Its Effect on Charge Transport JEREMY W. WARD, ABDULMALIK OBAID, CYNTHIA S. DAY, Wake Forest University, JOHN E. ANTHONY, University of Kentucky, OANA D. JURCHESCU, Wake Forest University — Small-molecule organic semiconductors are of great interest to understanding fundamental properties of charge transport in organic semiconductors as they offer relatively structurally simple model systems. The crystal packing plays a crucial role in determining the electronic performance of a material, as we demonstrate for the case of fluorinated 5,11-bis(triethylsilylethynyl)anthradithiophene. Increased interest in this compound is driven by the recent demonstrations of its high stability and high performance in organic field-effect transistors. This material exhibits a structural phase transition around $T = 294$ K, however properties below $T = 230$ K have not been investigated in detail. We identify an additional polymorph that forms below $T = 200$ K and shows distinct properties compared to the previously reported polymorphs. We identity the phase transition generating the new polymorph using grazing incidence X-Ray diffraction, field-effect transistor electrical characterization and differential scanning calorimetry. The evolution of the field-effect mobility with temperature shows a one order of magnitude increase in value as the films transition from a pure phase to a co-existence of two phases. The structural changes in the film modify the injection picture in these devices, and irreversibly increase the contact resistance two orders of magnitude.

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