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Interface and Contact Formation in Pentacene Monolayer Transistors BYOUNG-NAM PARK, SOONJOO SEO, FAN ZHENG, FRANZ HIMPSEL, PAUL EVANS, University of Wisconsin-Madison — Understanding charge transport in the accumulation layer of organic field effect transistors is crucial to improving their performance. Our in-situ electrical measurements during the deposition of pentacene onto a bottom-contact transistor structure with a silicon dioxide gate dielectric allowed us to study the formation of a transistor channel at the single- molecular-layer scale. At pentacene coverages near a percolation threshold the monolayer-high islands come into contact and current begins to flow through the channel. Using pauses in the deposition we have extracted transistor characteristic parameters with well-defined submonolayer island structures. Van der Pauw sheet resistance measurements show that the small field effect mobilities of monolayer transistors are associated with the formation of contacts rather than with the mobility of carriers within the semiconductor layer. Both near edge x-ray absorption fine structure measurements and atomic force microscopy show that the morphology and crystal structure of the pentacene layers changed as the total amount deposited onto the sample increased through the few-monolayer regime.

Paul Evans
University of Wisconsin-Madison

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