

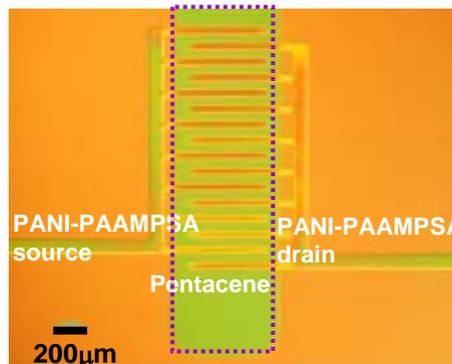
DEVELOPING A SOFT LITHOGRAPHY AND PRINTING FACILITY FOR RESEARCH AND EDUCATION IN ELECTRICALLY-ACTIVE ORGANIC MATERIALS

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DMR-0314707

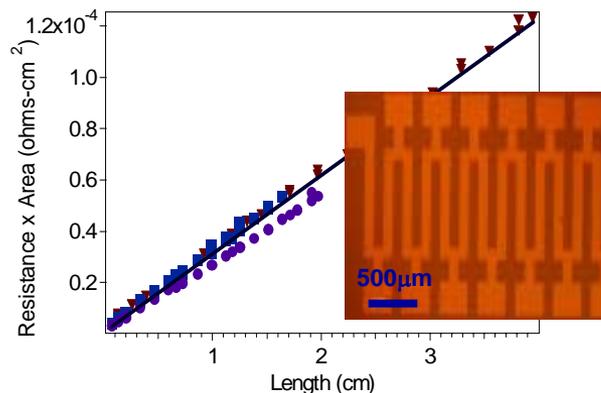
Research. This award supported the set-up of a soft-wall modular cleanroom for research in organic electrically-active materials and soft lithography. Specifically, we purchased a custom-built combination electron gun/thermal evaporator, a photolithography station, an optical microscope, and a bench-top reactive ion etcher for the cleanroom with funds from DMR.



Second-year chemical engineering graduate student **Kwangseok Lee** fabricates conductive polyaniline patterns by a simple stamp-and-spin-cast technique developed in our laboratories.



Top view of an organic thin-film transistor that uses pentacene organic semiconductor and conductive polyaniline electrodes that were patterned by stamp-and-spin-cast [1].



Thin copper wires printed by nanotransfer printing (nTP) – a completely additive transfer process that does not require solvents or any subsequent etching steps for pattern definition [2].

[1]. K.S. Lee, G.B. Blanchet, F. Gao, Y.-L. Loo, "Patterning Water-Soluble Polyaniline Electrodes for Pentacene Thin-Film Transistors," *ACS Polymeric Materials: Science and Engineering Preprints* **90**, 214, 2004.

[2]. K.C. Felmet, Y.M. Sun, Y.-L. Loo, "Patterning Conductive Copper by Nanotransfer Printing," accepted *Applied Physics Letters*, August 2004.

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Education. This cleanroom infrastructure is used by 4 chemical engineering graduate students, 3 undergraduates for their PhD and Bachelor's research thesis, respectively. Selected undergraduates (8 out of 40) in ChE 264, "Chemical Engineering Process and Projects Laboratory" also used the instrumentation for their semester-long special projects. During the summer of 2004, a Westwood High School student also participated in research in the cleanroom.



Group picture taken during summer short course on solid-state electronics, August 2004. From L to R: **James Norman** (ChE undergraduate); **Dmitry Krapchetov** (BSE in ChE, Texas A&M University, 2003); **Tracy Bucholz** (BSE in ChE and BS in Chemistry, University of Florida, 2003; Department of Homeland Security Graduate Fellow); **Quinn Smith** (PhD in Polymer Chemistry, University of Southern Mississippi, 2002); **Fawad Khan** (ChE undergraduate); **Kimberly Felmet** (BSE in ChE, Cornell University, 1999); **Kwangseok Lee** (Masters in MSE, Seoul National University, 2001); **Prof. Lynn Loo** (PI) ; **Prof. Joerg Schulze** (Institute of Physics, University of Munich Armed Forces); **Kyle Guice** (BSE in ChE, Louisiana Tech University, 2004; National Science Foundation Graduate Fellow).