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**Infrared study of charge injection in organic field-effect transistors**

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We present a systematic infrared (IR) spectroscopic study of charge injection in organic field-effect transistors (FET). These experiments have revealed new unexpected aspects of both polymers and molecular crystals. IR spectromicroscopy was employed to image the charges in poly(3-hexylthiophene) (P3HT) FETs. The charge density profile in the conducting channel uncovers a density-dependent mobility in P3HT due to disorder effects. Our IR studies of single crystal rubrene based FETs show that charge transport in these devices at room temperature is governed by light quasiparticles in molecular orbital bands. This result is at variance with the common beliefs of polaron formation in molecular solids. The above experiments have demonstrated the unique potential of IR spectroscopy for investigating physical phenomena at the nanoscale occurring at the semiconductor-insulator interface in FET devices. This work is in collaboration with G. M. Wang, D. Moses, A. J. Heeger (UCSB), V. Podzorov, M.E. Gershenson (Rutgers), Z. Hao, M. C. Martin (ALS), N. Sai, A. D. Meyertholen, M. M. Fogler, M. Di Ventra and D. N. Basov (UCSD).