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Infrared Imaging of Charge Injection Landscape in Organic Field-Effect Transistors ZHIQIANG LI, UCSD, GUANGMING WANG, UCSB, NA SAI, UCSD, DANIEL MOSES, UCSB, MICHAEL MARTIN, Lawrence Berkeley National Laboratory, MASSIMILIANO DI VENTRA, UCSD, ALAN HEEGER, UCSB, DIMITRI BASOV, UCSD, UCSD COLLABORATION, UCSB COLLABORATION, LAWRENCE BERKELEY NATIONAL LABORATORY COLLABORATION — We report on infrared (IR) spectro-microscopy study of charge injection phenomena in organic field-effect transistors (OFET) based on regioregular poly(3-hexylthiophene) (P3HT). An analysis of the oscillator strength of the spectroscopic signatures of charge injection allowed us to quantify the density of the injected carriers and examine its evolution with applied voltages. Using IR microscopy, the uniformity of the field- induced charge layer in OFETs with high dielectric constant insulator TiO_2 as well as SiO_2 as gate dielectrics was explored. These data uncover the critical role of the gate insulator in defining the relevant charge injection length scales. This work demonstrates the unique potential of IR spectroscopy for the investigation of the electronic excitations in nanometer-thick accumulation layers in OFET devices.

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