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Infrared spectroscopy of narrow gap donor-acceptor polymer-based ambipolar transistors OMAR KHATIB, University of California, San Diego, JONATHAN YUEN, University of California, Santa Barbara, JIM WILSON, University of California, San Diego, RAJEEV KUMAR, Nano Terra, MASSIMILIANO DI VENTRA, University of California, San Diego, ALAN HEEGER, University of California, Santa Barbara, DIMITRI BASOV, University of California, San Diego — Donor-acceptor (D-A) copolymers have recently emerged as versatile materials for use in a large variety of device applications. Specifically, these systems possess extremely narrow band gaps, enabling ambipolar charge transport when integrated in solution-processed organic field-effect transistors (OFETs). However, the fundamentals of electronic transport in this class of materials remain unexplored. We present a systematic investigation of ambipolar charge injection in a family of narrow-gap D-A conjugated polymers based on benzobisthiadiazole (BBT) using infrared (IR) spectroscopy. We observe a significant modification of the absorption edge in polymer-based OFETs under the applied electric field. The absorption edge reveals hardening under electron injection and softening under hole injection. Additionally, we register localized vibrational resonances associated with injected charges. Our findings indicate a significant self-doping of holes that is modified by charge injection. Observations of both electron and hole transport with relatively high carrier mobility strongly suggest an inhomogeneous, phase-separated conducting polymer.

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