Highlights

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Electron injection barrier and energy-level alignment at the Au/PDI8-CN_2 interface via current–voltage measurements and ballistic emission microscopy

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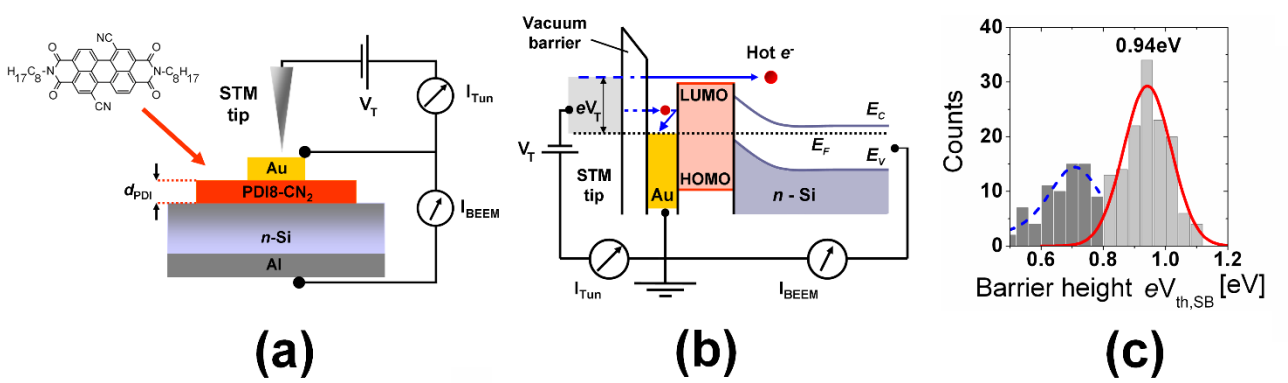
We probe electron transport across the Au/organic interface based on oriented thin films of the high-performance n-type perylene diimide semiconductor PDI8-CN_2. Temperature-dependent current–voltage characteristics and complementary ballistic electron emission microscopy studies reveal that rectification at the Au/PDI8-CN_2 interface is controlled by a spatially inhomogeneous injection barrier, that varies on a length scale of tens of nanometers according to a Gaussian distribution with mean value ~0.94 eV and standard deviation ~100 meV. The former gradually shifts to ~1.04 eV on increasing PDI8-CN_2 thickness from 5 nm to 50 nm. Experimental evidences and general arguments further allow to establish the energetics at the Au/PDI8-CN_2 interface. Our work indicates injection-limited current flow in PDI8-CN_2-based devices with evaporated Au electrodes.



(a) Schematic diagram of the Au/PDI8-CN_2/n-Si contact barrier diode and (b) the set-up for ballistic electron emission microscopy BEEM measurements. (c) Histogram of the local barrier heights extracted from individual BEEM spectra.

M. Barra, F.V. Di Girolamo, F. Chiarella, M. Salluzzo, Z. Chen, et al., J. Phys. Chem. C 114, 20387 (2010)
A. Gerbi, R. Buzio, A. Gadaleta, A. Anghinolfi, et al., Adv. Mater. Interfaces 1, 1300057 (2014)