

Supporting Information

Charge Carrier Transport and Contact Selectivity Limit the Operation of PTB7-Based Organic Solar Cells of Varying Active Layer Thickness

Antonio Guerrero¹, Nuria Fernández-Montcada², Jon Ajuria^{3,4}, Ikerne Etxebarria^{3,4}, Roberto Pacios^{3,4}, Germà Garcia-Belmonte^{1*}, and Emilio Palomares^{*2,5}

¹*Photovoltaic and Optoelectronic Devices Group, Departament de Física, Universitat Jaume I, ES-12071 Castelló, Spain*

²*Institute of Chemical Research of Catalonia (ICIQ). Avda. Països Catalans 16. Tarragona. E-43007. Spain.*

³*IK4-IKERLAN, Goiru Kalea, 20500 Arrasate. Spain*

⁴*CIC microGUNE, 20500 Arrasate, Spain*

⁵*ICREA. Passeig Lluís Companys, 23. Barcelona E-08010. Spain.*

*Corresponding authors: G. Garcia-Belmonte, e-mail: garciag@fca.uji.es, tel.: +34 964387548, and Emilio Palomares, email : epalomares@iciq.es, tel. +34977920241.

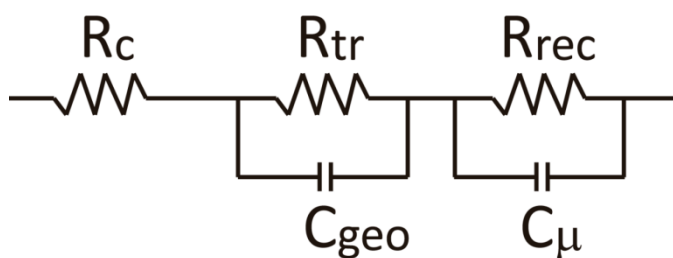


Figure SI1: Equivalent circuit model used in this work. R_c is the series resistance due to contacts and wires. R_{tr} is a resistance to transport of carriers observed at high frequency for systems limited by transport of carriers. R_{rec} is the recombination resistance observed at low frequency. C_{geo} is the geometrical capacitance of the device and C_{μ} a chemical capacitance.

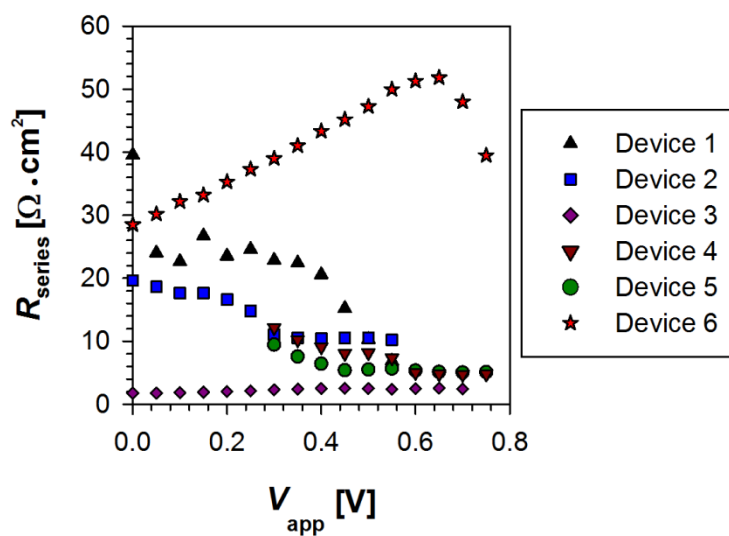


Figure SI2: Calculated total series resistance using Impedance Spectroscopy taking into account the contact resistance and response at high frequencies ($R_{series} = R_c + R_{tr}$)

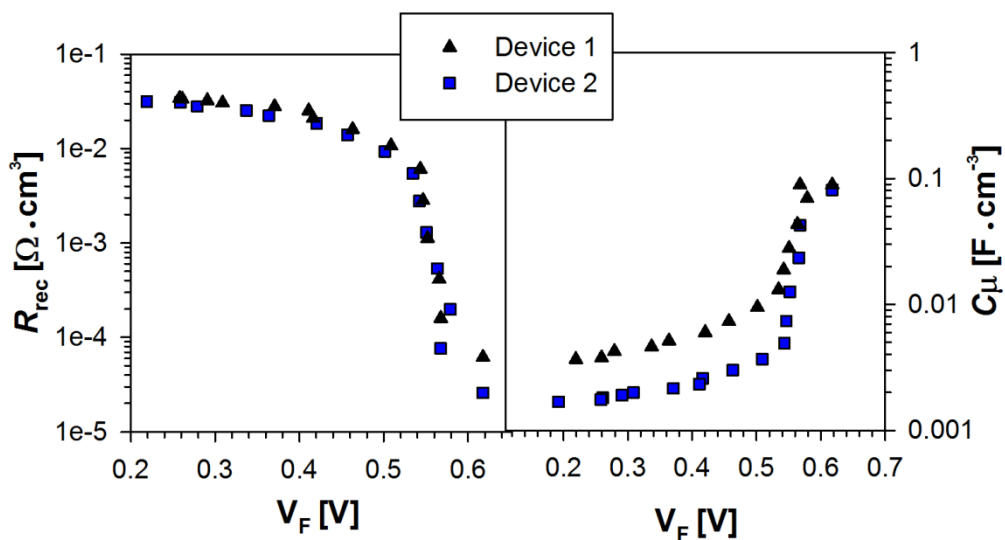


Figure S13: Recombination resistance (R_{rec}) and Chemical capacitance (C_{μ}) as a function of the applied voltage corrected to take into account the voltage drop due to the series resistance ($V_F = V_{app} - j \cdot R_{series}$).

Capacitance-Voltage analysis

Active Layer	Donor:Acceptor Ratio	Thickness	V_{FB} [V]	Fullerene cathode Fullerene Coverage [%]
P3HT	1:0	100 nm	1.42	0
P3HT:PCBM	1:6	200 nm	0.32	100
Device 1	1:1	100 nm	0.450	90
Device 2	1:1	270 nm	0.377	95
PTB7	1:0	100 nm	1.30	0
PTB7:PCBM	1:6	200 nm	0.52	100
Device 3	1:3	100 nm	0.673	80
Device 4	1:3	100 nm	0.633	85
Device 5	1:1	100 nm	1.022	35
Device 6	1:1	270 nm	0.770	65

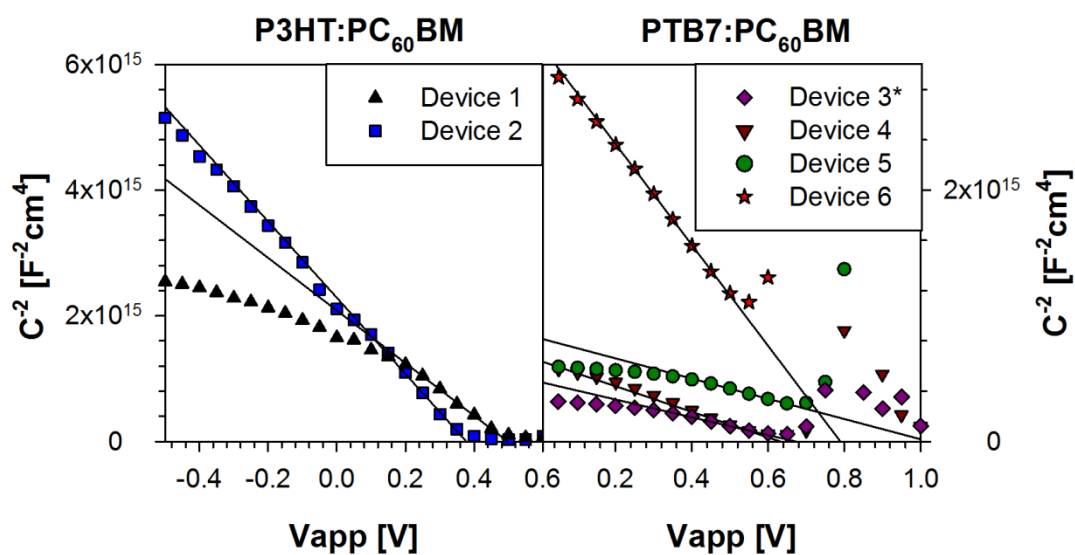


Figure SI4: Mott-Schottky analysis of devices fabricated in this work. Measurements have been carried out at a frequency of 1 kHz and dark conditions. *PC₇₀BM and DIO were used as acceptor molecule and additive, respectively.