Mapping polarons in polymer FETs by charge modulation microscopy in the mid-infrared

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Supplementary Info

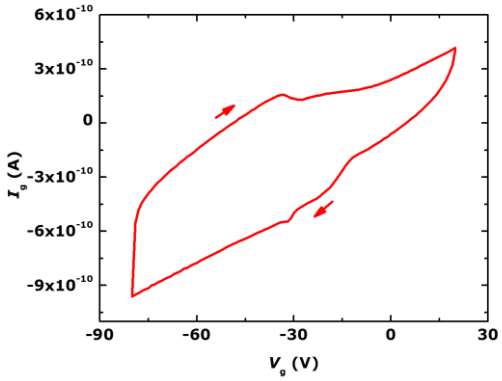

Figure S 1: Gate leakage current measurement of P3HT FET with V_{ds} = 0 V. The leakage current at V_g = - 80 V is less than -1 nA, which is about 100 times smaller than the working current level. Limited hysteresis is observed.

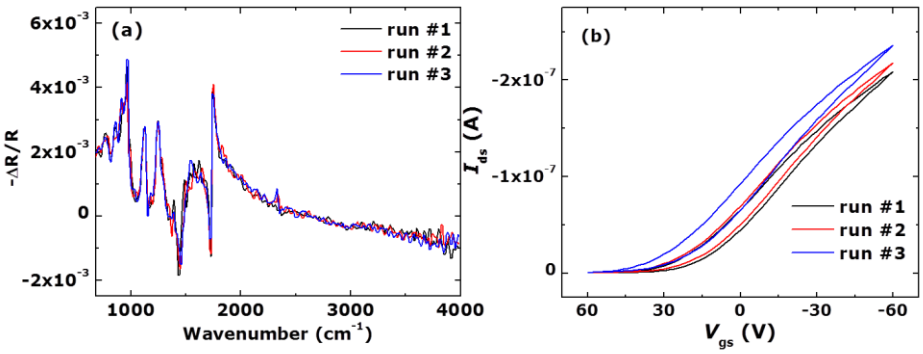

Figure S 2: (a) Consecutive acquisitions of CMS reflectance spectra in ambient air condition with V_{on} = -60 V, V_{off} = 40 V, V_{ds} = 0 V and (b) corresponding FET transfer characteristics. Despite the notable shift in threshold voltage observed in panel (b) and summarized in Table S 1, CMS spectra acquired with $V_{off} < V_{th}$ are stable over time. This is due to the fact that threshold voltage shift does not affect mobility (see Table S 1), hence the differential current. Note that typical P3HT C-H stretching modes around 3000 cm^{-1} are not observed by electromodulation.

run#	μ_{sat} ($cm^2V^{-1}s^{-1}$)	V_{th}(V)
1	1.76E-03	44.8
2	1.73E-03	46.5
3	1.62E-03	55.7

Table S 1: Summary of saturation mobility μ_{sat} and threshold voltage (V_{th}) extracted from the FET transfer characteristics in Figure S 2(b).

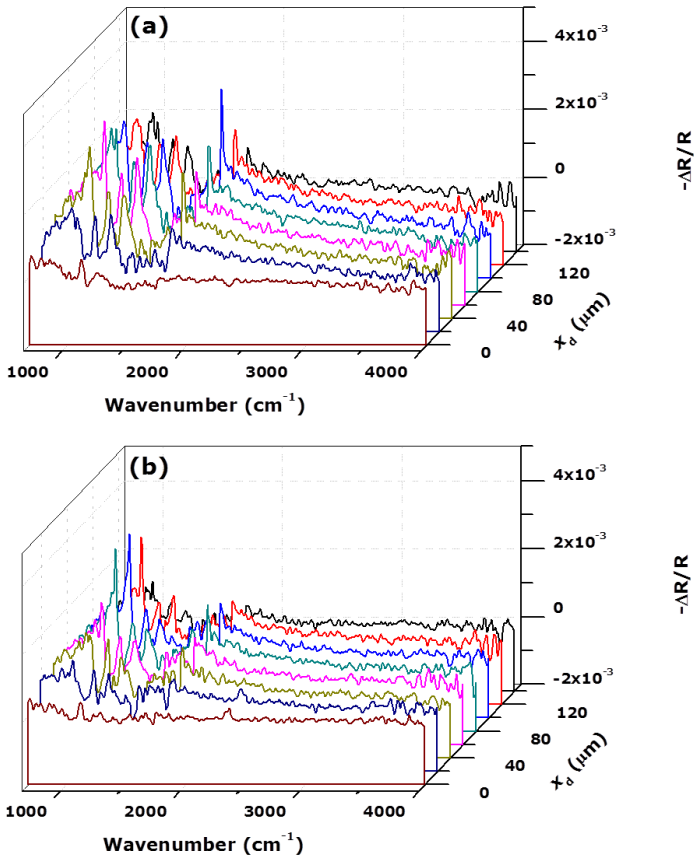

Figure S 3: CMS reflectance mapping across the channel of the P3HT FET with V_{on} = -60 V and V_{off} = 80 V at (a) V_{ds} = 0 V and (b) V_{ds} = -120 V. 100 spectra were averaged at each position to increase signal to noise ratio. While in (a) the CMS spectra do not vary along the conduction channel, indicating that with zero source-drain bias the corresponding carrier density is uniformly distributed, in (b) the electromodulated reflectance intensity decreases from source to drain due to charge depletion at the drain side induced by the drain-source voltage.

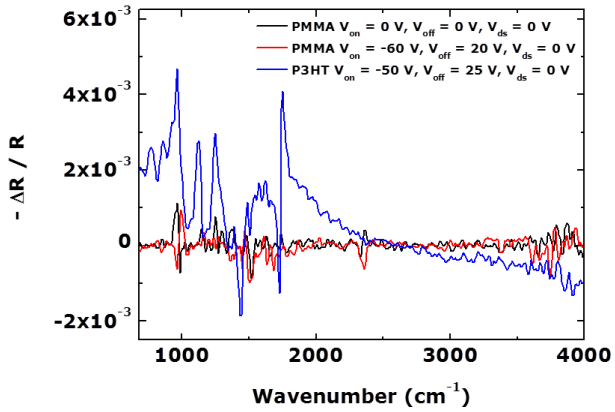

Figure S 4: Control CMS measurement on FET with PMMA only. The black and red CMS spectra are recorded in an FET without P3HT active layer, while the blue CMS spectra are recorded using the device shown in the inset of **Figure 1** (a). Due to the absence of strong vibrational features above the noise level in the CMS spectra of the control samples with PMMA only, IRAV features can safely be attributed to the active P3HT layer.