Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting information

Bottom-up Fabrication of Graphene-based Conductive Polymer Carpets for Optoelectronics

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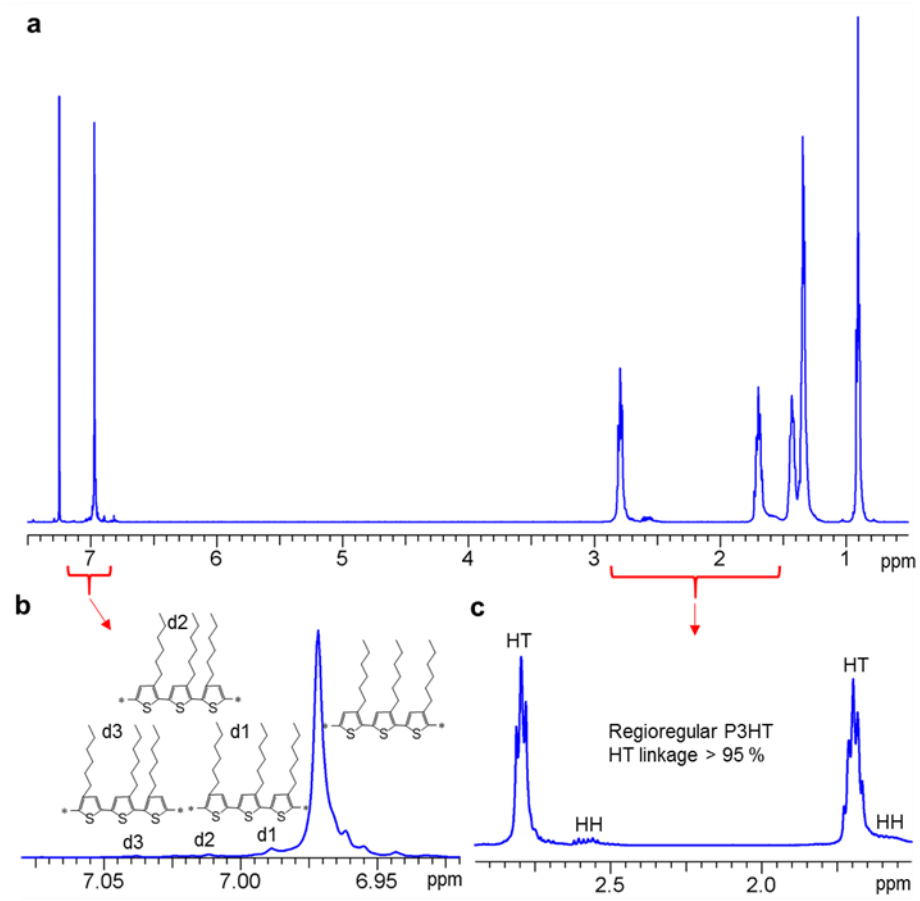

Figure S1. ^{1}H NMR (500 MHz, $CDCl_3$) spectrum of P3HT collected from solution. (a) Whole spectrum. (b) A close-up of aromatic proton region. The d1 - d3 represent the defects in the P3HT structure. (c) A close-up of α-methylene β-methylene proton regions. All regions indicate that the P3HT has high percentage of regioregular head-to-tail (HT) linkage (> 95%).

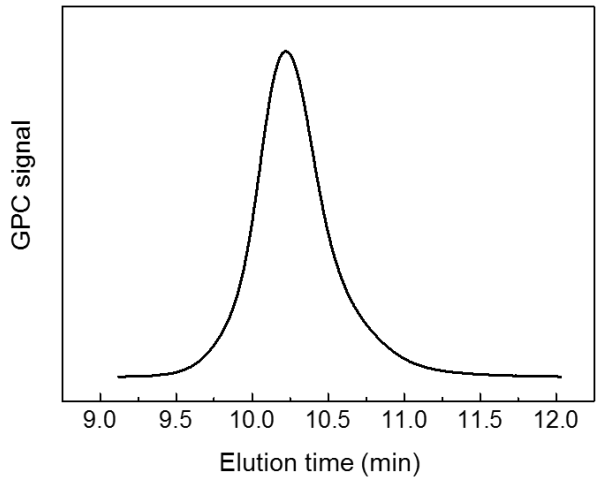

Figure S2. Gel permeation chromatography traces for P3HT polymer collected from solution. M_n = 12000 g/mol, $Đ$ = 1.5.

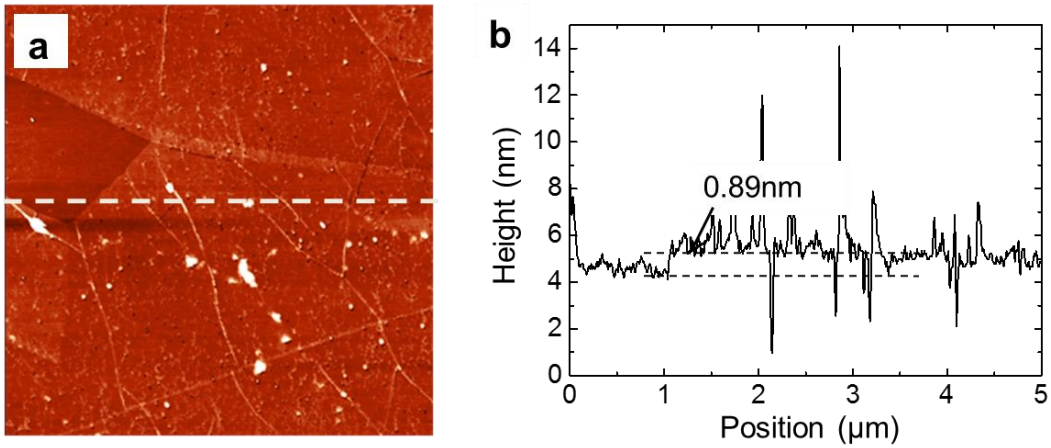

Figure S3. Monolayer layer graphene. (a) AFM topography and (b) height profile of single layer graphene on 300 nm SiO_2/Si.

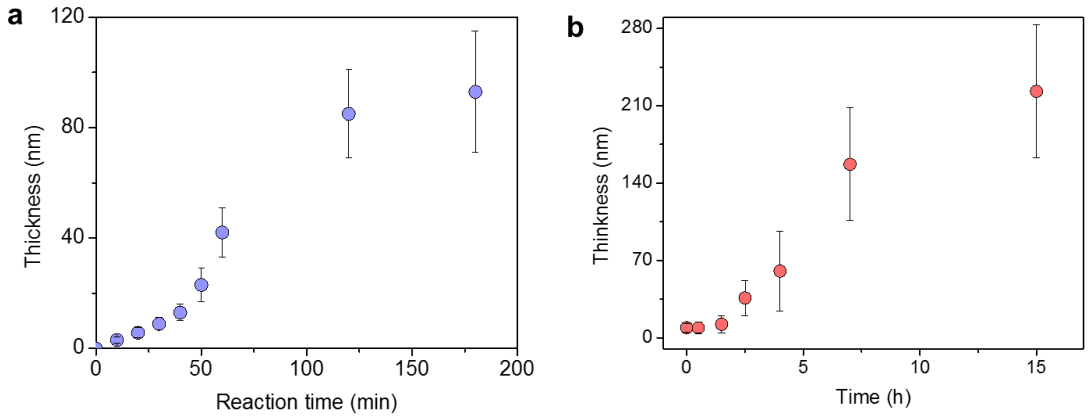

Figure S4. Development of PSBr and P3HT thickness with reaction time. (a) PSBr thickness vs. SIPGP reaction time. (b) P3HT thickness vs. SI-KCTP reaction time.

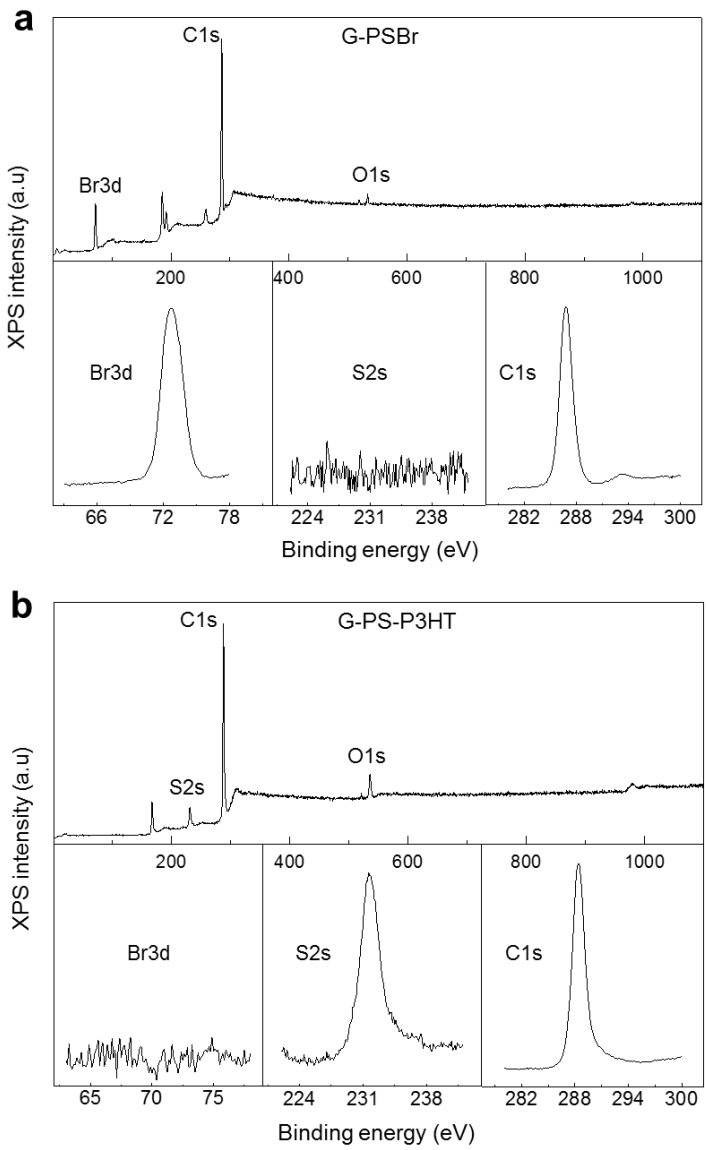

Figure S5. XPS survey spectrum and high resultion element scan of Br3d, S2s and C1s of the (a) PSBr modified graphene and the same sample after grafting of (b) P3HT by SI-KCTP.

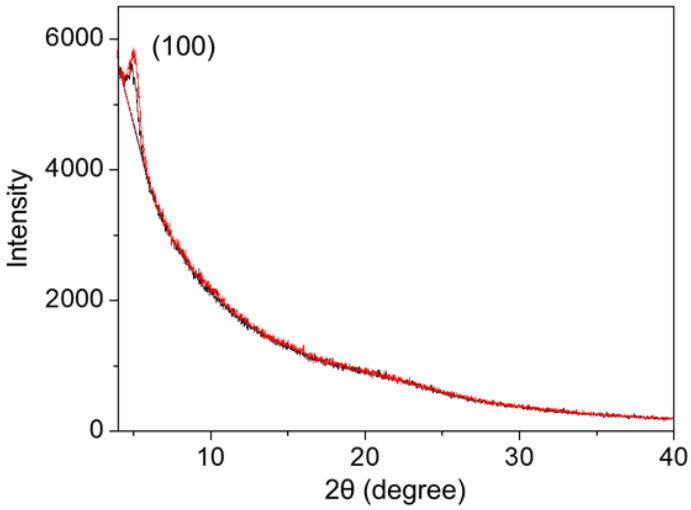

Figure S6. GI-XRD of G-PS-P3HT on 300 nm SiO_2/Si wafer. The two sets of curves (black and red) are belong to two identical samples.

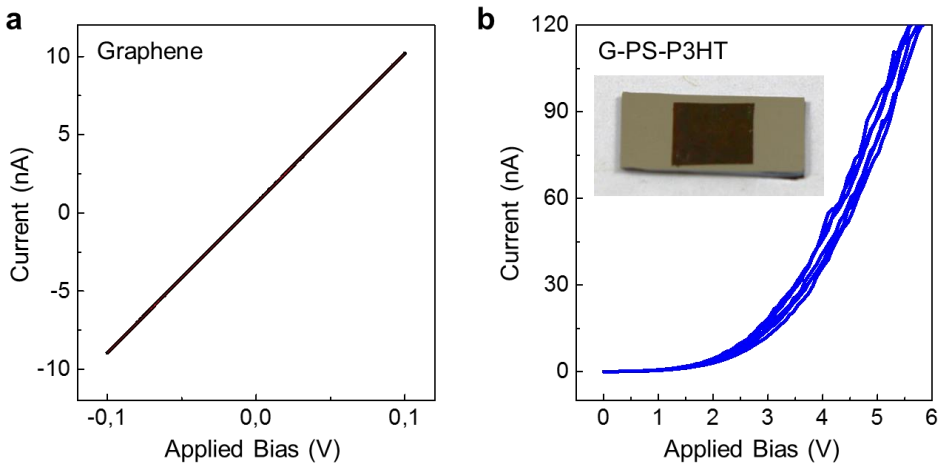

Figure S7. Representative I-V characteristics collected by conductive mode atomic force microscopy for (a) single layer graphene and (b) 200 nm thick G-PS-P3HT carpets on Au coated Si wafer substrate.

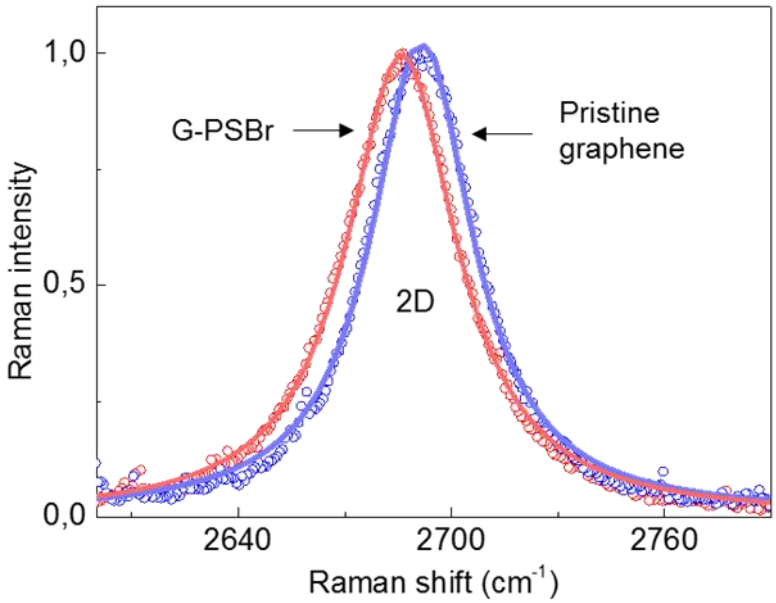

Figure S8. Raman spectra of the 2D band region for graphene and graphene/PSBr. The invariability of the 2D peak width reflects the preservation of crystallinity of graphene after functionalization. The doping/charge effect of PSBr is reflected as the shift in peak position.

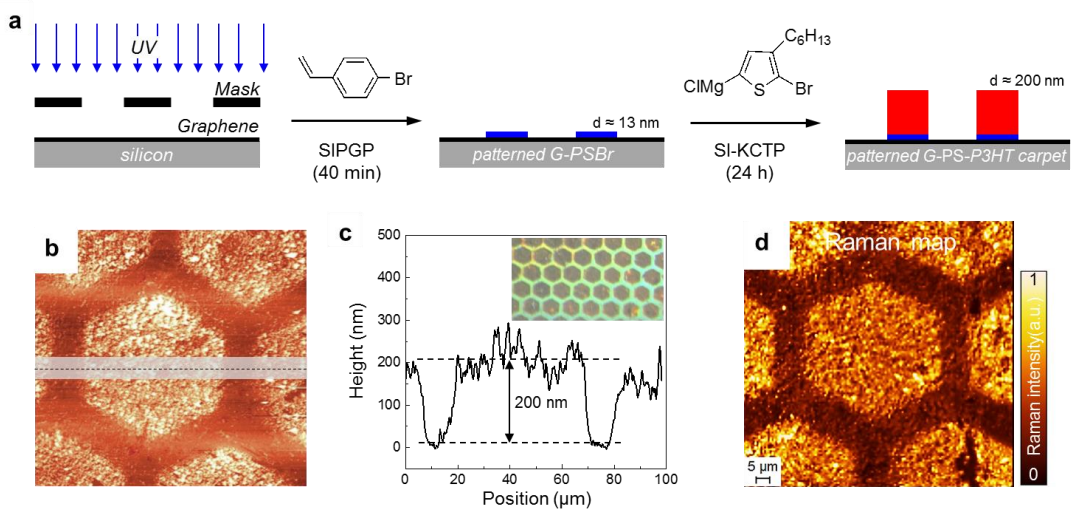

Figure S9. Micropatterned G-PS-P3HT. (a) Schematic illustrations showing the fabrication processes by SIPGP of 4-bromostyrene using a mask, followed by SI-KCTP of 3-hexylthiophene. (b) Topography image obtained by AFM and (c) the height profile corresponding to the dashed line in the AFM image, inset: optical micrograph of microstructured G-PS-P3HT. (d) Mapping of integrated Raman intensity of P3HT shows only minor amounts of polymer traces appeared in the non-irradiated parts (branches) probably due to physical adsorption

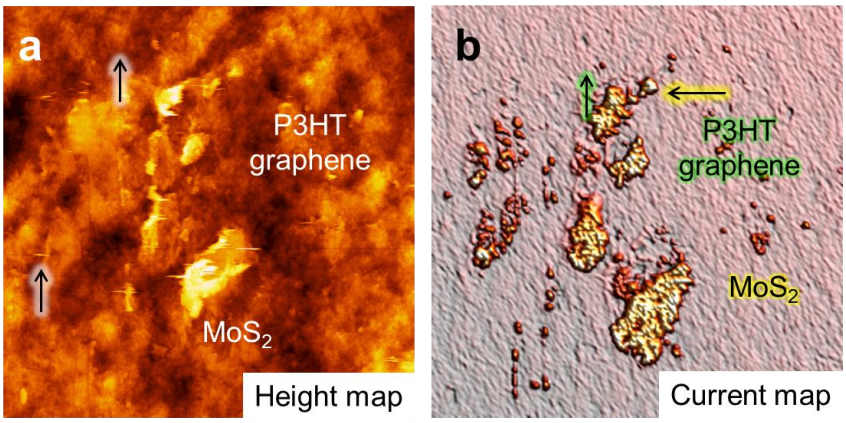

Figure S10. Height and conductive AFM imaging. (a) AFM topography and (b) conductive image of p-n heterostructure of MoS_2 flakes deposited on G-PS-P3HT surface. A significantly high photocurrent was observed on the P3HT region where MoS_2 introduced.