

## Supporting Information

# Conjugated Polymers with 2,7-Linked 3,6-Difluorocarbazole as Donor Unit for High Efficiency Polymer Solar Cells

Chun Du,<sup>†</sup> Weiwei Li,<sup>†</sup> Yan Duan,<sup>†</sup> Cuihong Li,<sup>\*,†</sup> Huanli Dong,<sup>‡</sup> Jia Zhu,<sup>\*,†</sup> Wenping

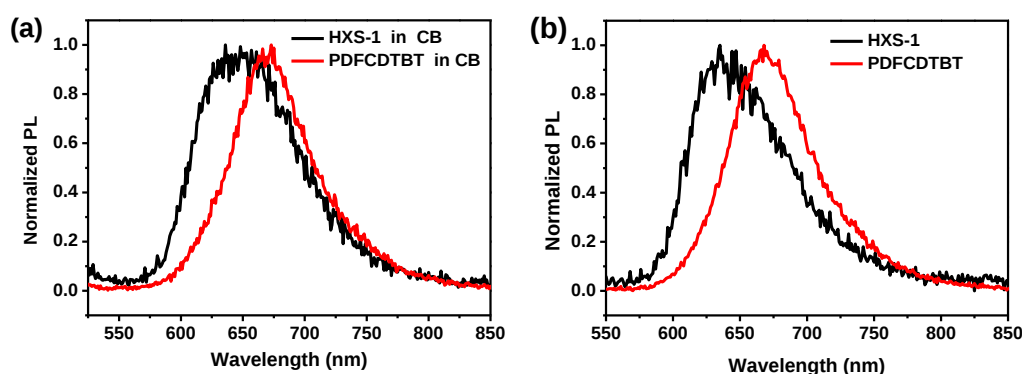
Hu,<sup>‡</sup> Zhishan Bo<sup>\*,†</sup>

Beijing Key Laboratory of Energy Conversion and Storage Materials, College of

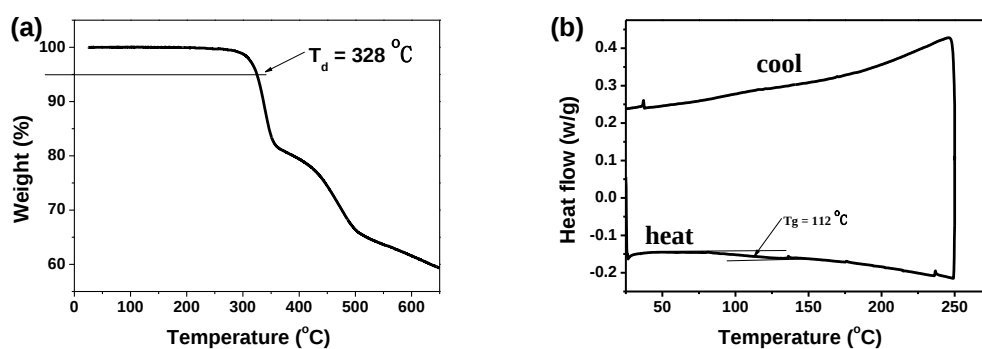
Chemistry, Beijing Normal University, Beijing 100875, China

Institute of Chemistry, Chinese Academy of Sciences, Beijing 100190, China Email

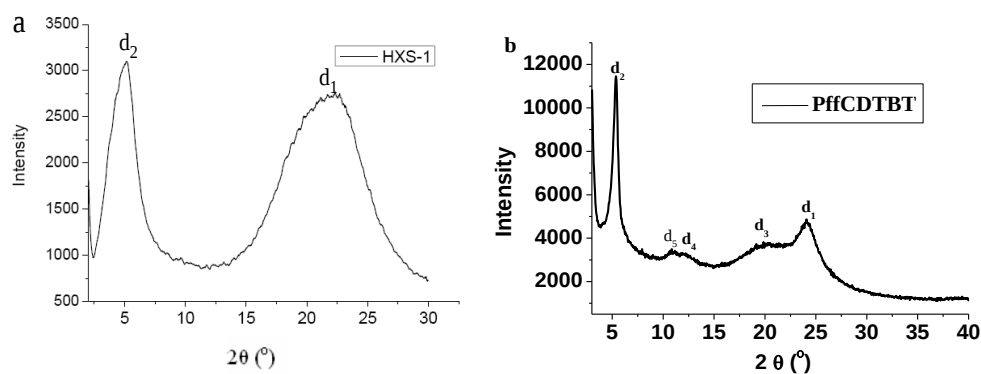
Addresses: licuihong@bnu.edu.cn; zhu.jia@bnu.edu.cn; zsbo@bnu.edu.cn



**Figure S1.** Normalized photoluminescence spectra of **HXS-1** and **PDFCDTBT** in CB solution (a) and in thin films (b).



**Figure S2.** (a) Thermogravimetric curve and (b) differential scanning calorimetry curves (second run) of **PDFCDTBT** at a heating rate of 10 °C/min.



**Figure S3.** X-ray diffraction pattern of (a) powdery **HXS-1** and (b) **PDFCDTBT**.

**Table S1.** Summary of XRD data of powdery **HXS-1** and **PDFCDTBT** samples.

| Sample           | <b>HXS-1</b> |      | <b>PDFCDTBT</b> |      |      |      |      |
|------------------|--------------|------|-----------------|------|------|------|------|
| $2\theta$ (°)    | 22.3         | 5.2  | 24.1            | 20.5 | 12.3 | 10.9 | 5.36 |
| $d$ -spacing (Å) | 4.0          | 17.0 | 3.7             | 4.3  | 7.2  | 8.1  | 16.5 |

**Table S2.** Photovoltaic parameters of **PDFCDTBT:PC<sub>71</sub>BM** based solar cells fabricated from DCB, DCB with 2.5% vol DIO, and DCB with 2% vol CN.

| PDFCDTBT:PC <sub>71</sub> B<br>M | Solvent     | $V_{oc}$<br>[V] | $J_{sc}$<br>[mA/cm <sup>2</sup> ] | FF   | PCE<br>[%] | Thickness<br>[nm] |
|----------------------------------|-------------|-----------------|-----------------------------------|------|------------|-------------------|
| 1:3                              | DCB+2.5%DIO | 0.7             | 6.5                               | 0.45 | 2.13       | 88                |
| 1:3                              | DCB         | 0.7             | 8.6                               | 0.44 | 2.88       | 86                |
| 1:3                              | DCB+2%CN    | 0.8             | 9.4                               | 0.47 | 3.53       | 90                |

**Table S3.** Photovoltaic parameters of **PDFCDTBT:PC<sub>71</sub>BM** based solar cells with different ratio from 1:1 to 1:4 fabricated from DCB with 2% vol CN.

| PDFCDTBT:PC <sub>71</sub> BM | Solvent  | $V_{oc}$<br>[V] | $J_{sc}$<br>[mA/cm <sup>2</sup> ] | FF   | PCE<br>[%] | Thickness<br>[nm] |
|------------------------------|----------|-----------------|-----------------------------------|------|------------|-------------------|
| 1:1                          | DCB+2%CN | 0.85            | 7.8                               | 0.42 | 2.76       | 100               |
| 1:2                          | DCB+2%CN | 0.83            | 9.7                               | 0.51 | 4.14       | 102               |
| 1:3                          | DCB+2%CN | 0.86            | 8.8                               | 0.48 | 3.69       | 120               |
| 1:4                          | DCB+2%CN | 0.85            | 7.9                               | 0.42 | 2.85       | 125               |

**Table S4.** Photovoltaic parameters of **PffCDTBT:PC<sub>71</sub>BM** with different ratio from 1:1.6 to 1:2.8 fabricated from DCB with 2% vol CN.

| PDFCDTBT:PC <sub>71</sub> BM | Solvent  | $V_{oc}$<br>[V] | $J_{sc}$<br>[mA/cm <sup>2</sup> ] | FF   | PCE<br>[%] | Thickness<br>[nm] |
|------------------------------|----------|-----------------|-----------------------------------|------|------------|-------------------|
| 1:1.6                        | DCB+2%CN | 0.85            | 9.0                               | 0.54 | 4.14       | 91                |

|       |          |      |     |      |      |     |
|-------|----------|------|-----|------|------|-----|
| 1:1.8 | DCB+2%CN | 0.88 | 9.4 | 0.53 | 4.45 | 87  |
| 1:2.2 | DCB+2%CN | 0.86 | 9.0 | 0.54 | 4.19 | 83  |
| 1:2.5 | DCB+2%CN | 0.88 | 8.8 | 0.52 | 4.01 | 104 |
| 1:2.8 | DCB+2%CN | 0.88 | 8.2 | 0.48 | 3.47 | 102 |

