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


# Supporting Information

# Nonvolatile Transistor Memory Devices using High Dielectric Constant Polyimides Electrets

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+equal contribution to this work.

**Table S1.** Inherent Viscosity[a] and Solubility Behavior of Polyimides

| Code | $\eta_{inh}$ (dL/g) | Solubility in various Solvent[b] | | | | | |
|---|---|---|---|---|---|---|---|
| | | NMP | DMAc | DMF | *m*-Cresol | THF | $CHCl_3$ |
| **PI(BTDA-TPA-CN)** | 0.97 | ++ | ++ | ++ | ++ | +− | ++ |
| **PI(DSDA-TPA-CN)** | 0.42 | ++ | ++ | ++ | ++ | +− | +− |
| **PI(6FDA-TPA-CN)** | 0.94 | ++ | ++ | ++ | ++ | ++ | ++ |

[a] Measured at a polymer concentration of 0.5 g/dL in DMAc at 30 °C.

[b] The solubility was determined with a 10 mg sample in 1 mL of a solvent. ++, soluble at room temperature; +, soluble on heating; +−, partially soluble or swelling.

**Table S2.** Thermal Properties of Polyimides[a]

| Polymer code | $T_d^5$ (°C)[b] | | $T_d^{10}$ (°C)[b] | | $R_{w800}$ (%)[c] |
|---|---|---|---|---|---|
| | $N_2$ | Air | $N_2$ | Air | |
| **PI(BTDA-TPA-CN)** | 620 | 605 | 650 | 645 | 70 |
| **PI(DSDA-TPA-CN)** | 535 | 550 | 575 | 595 | 62 |
| **PI(6FDA-TPA-CN)** | 590 | 580 | 620 | 605 | 65 |

[a] The polymer film samples were heated at 300 °C for 1 h prior to all the thermal analyses.

[b] Temperature at which 5 % and 10% weight loss occurred, respectively, recorded by TGA at a heating rate of 20 °C/min and a gas flow rate of 20 $cm^3$/min.

[c] Residual weight percentages at 800 °C under nitrogen flow.

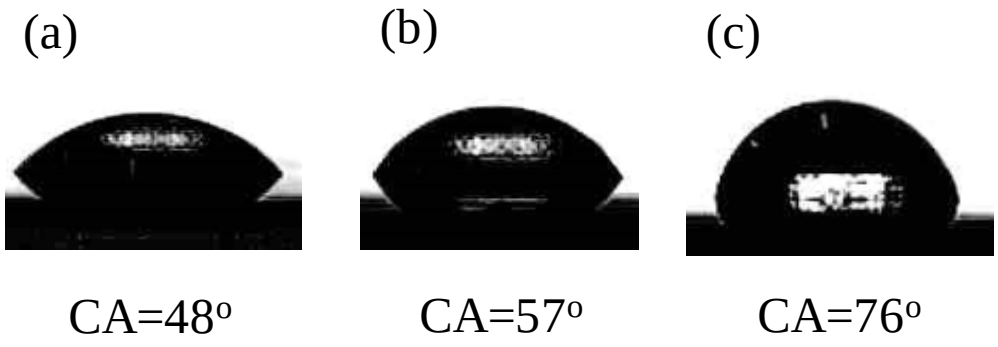


**Figure S1.** Contact angles of various polymer electrets: (a) **PI(BTDA-TPA-CN)**, (b) **PI(DSDA-TPA-CN)** and (c) **PI(6FDA-TPA-CN)**.

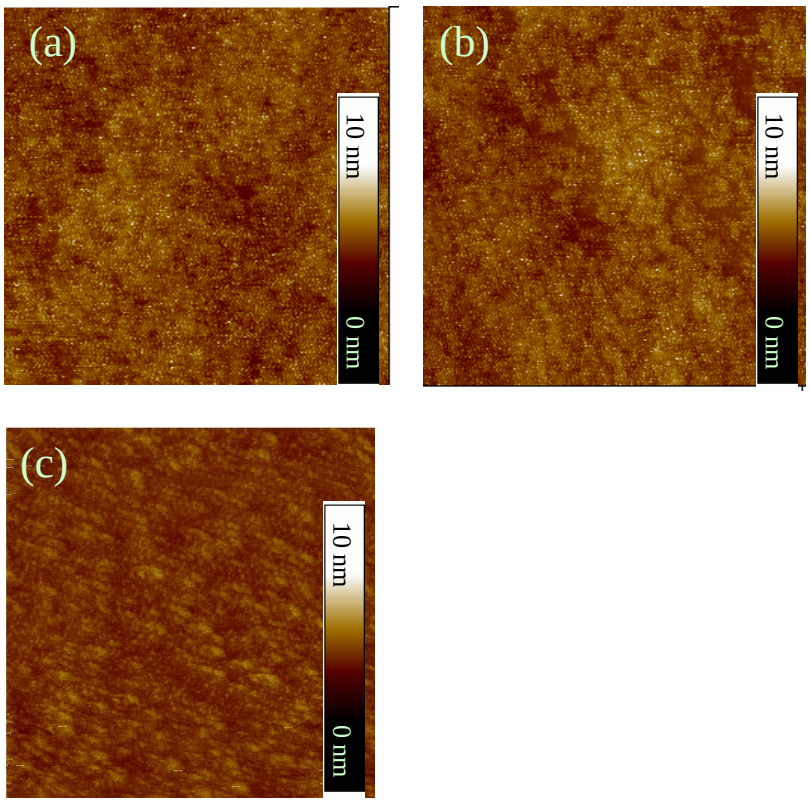


**Figure S2.** Atomic force microscopy (AFM) topographies of (a) **PI(BTDA-TPA-CN)**, (b) **PI(DSDA-TPA-CN)** and (c) **PI(6FDA-TPA-CN)** spin-coated on bare $SiO_2$ substrates on 1 μm x 1 μm areas.

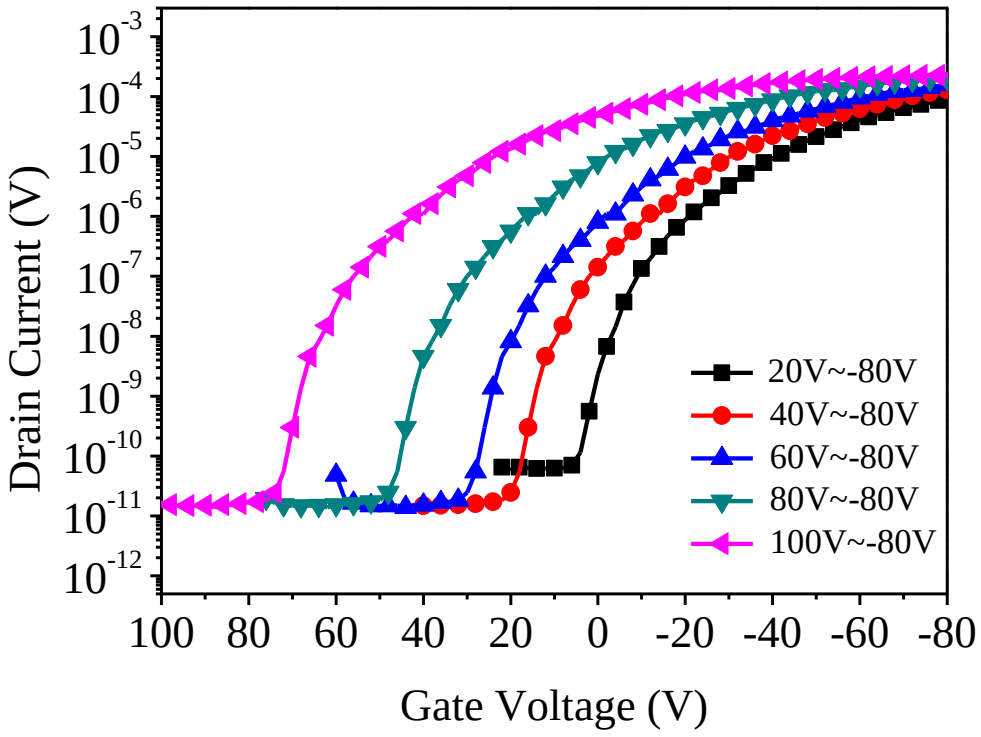


**Figure S3.** Transfer characteristics of the pentacene with **PI(6FDA-TPA-CN)** as electret. The $V_g$ sweeps ranged from 20 to 100 V.

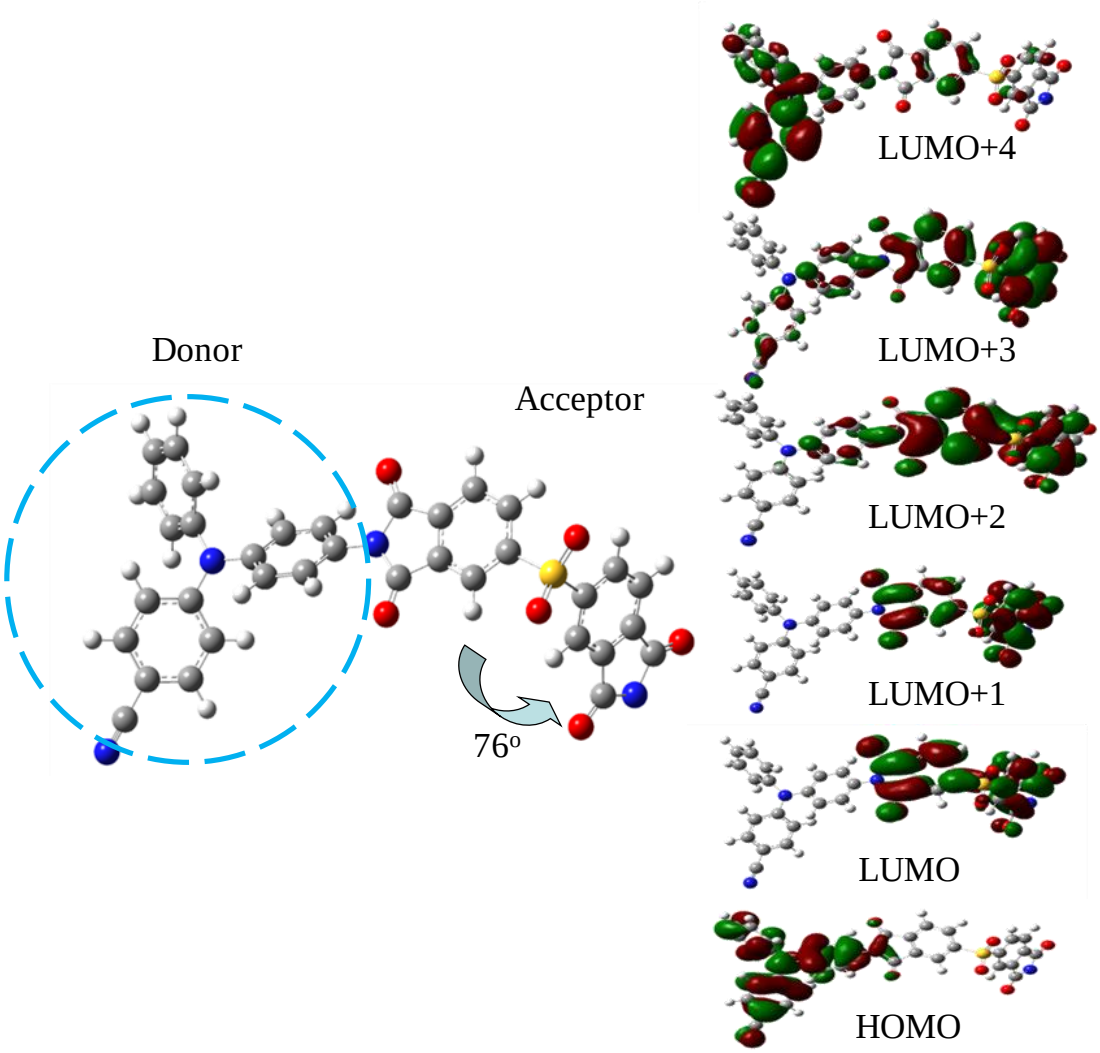


**Figure S4. Molecular orbitals of PI(DSDA-TPA-CN).**

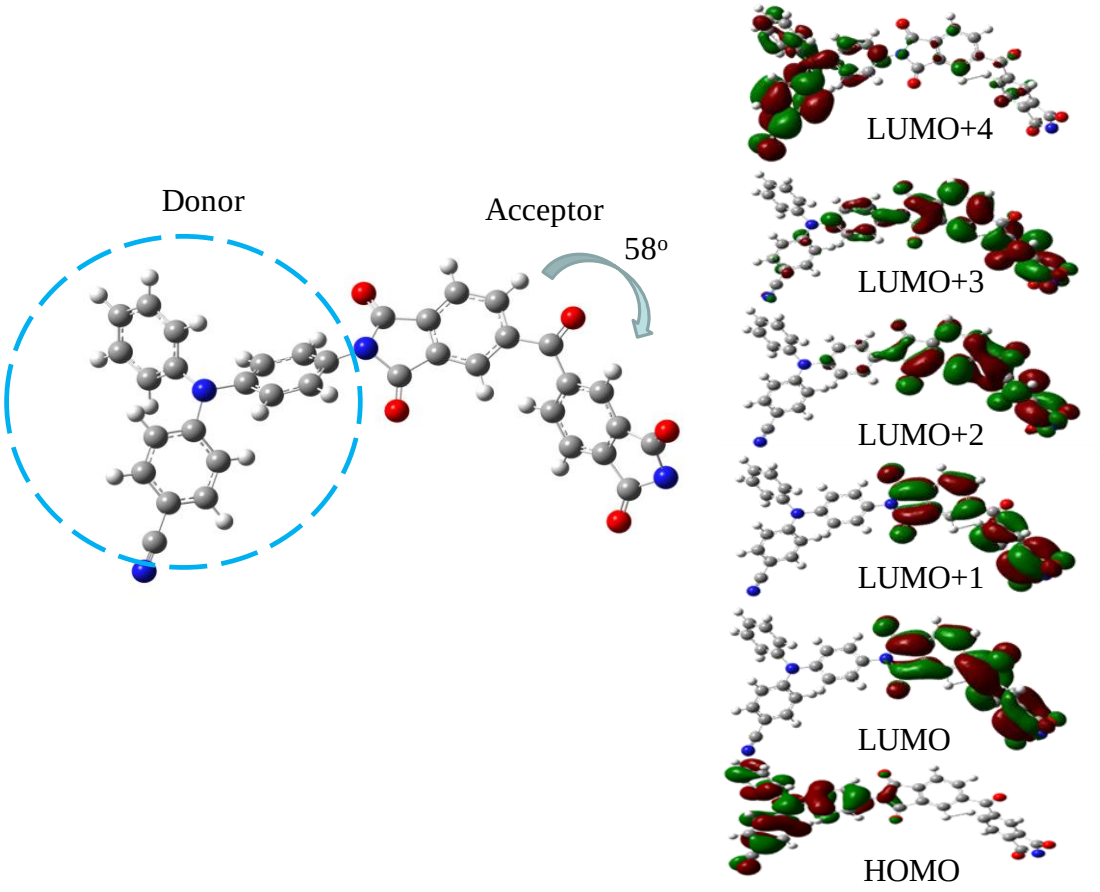


**Figure S5. Molecular orbitals of PI(BTDA-TPA-CN).**

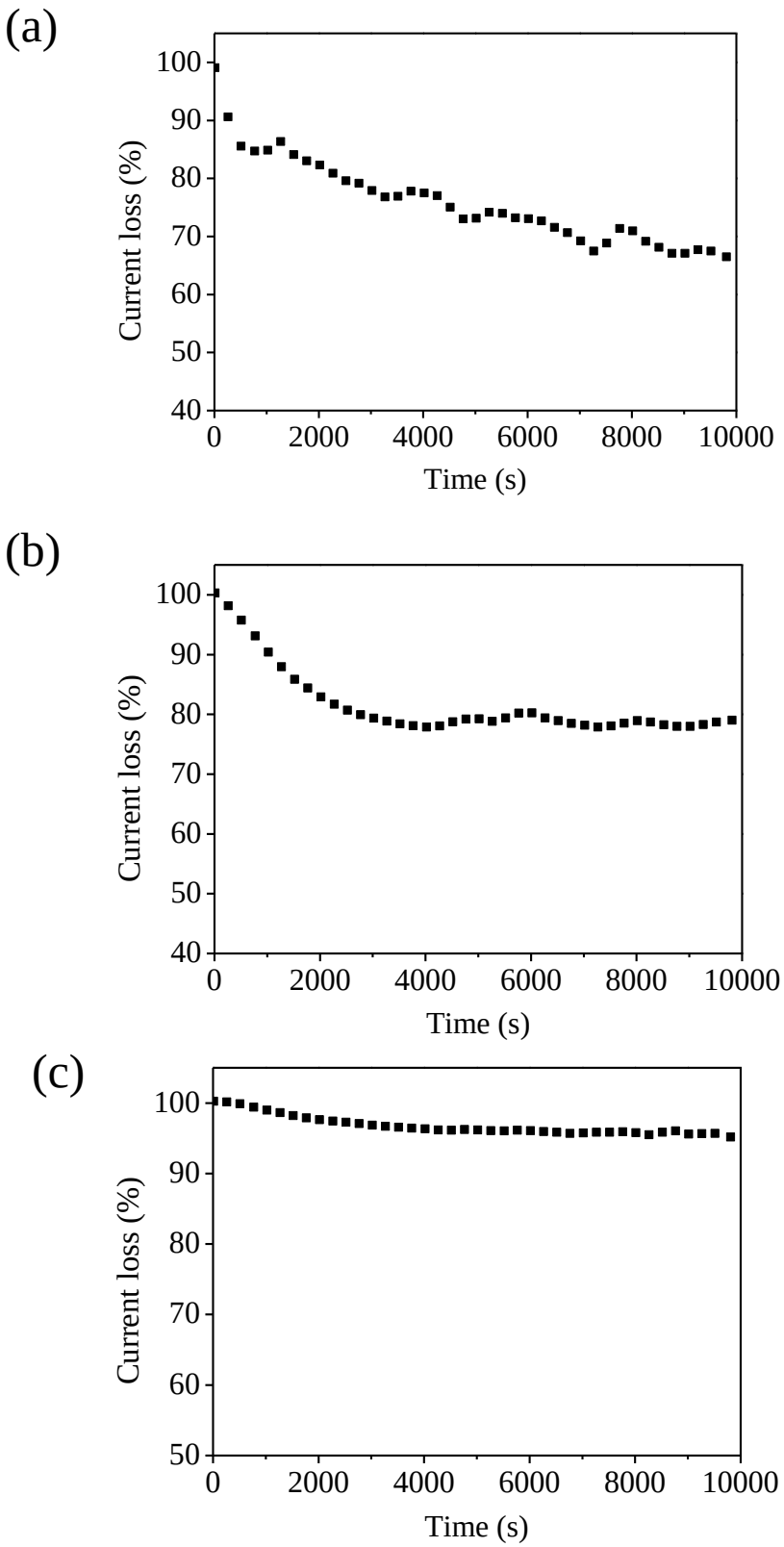


**Figure S6.** The on-current of OFET device decay through $10^4$ s storage with (a) **PI(BTDA-TPA-CN)**, (b) **PI(DSDA-TPA-CN)**and (c) **PI(6FDA-TPA-CN)** as electrets**.**