Supporting Information

Synthesis and characterization of novel donor-acceptor type
electrochromic polymers containing diketopyrrolopyrrole as
acceptor and propylenedioxythiophene or indacenodithiophene as
donor

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Fig. S1. $^1$H NMR spectrum of 3,3-Bis-decyl-3,4-dihydro-2H-thieno[3,4-b][1,4]dioxepine (a), CDCl$_3$ Solvent peak and water speak were marked by ‘x’, ‘y’ respectively, $^{13}$C NMR spectrum of 3,3-Bis-decyl-3,4-dihydro-2H-thieno[3,4-b][1,4]dioxepine (b), CDCl$_3$ Solvent peak were marked by ‘x’.

Fig. S2. $^1$H NMR spectrum of 6,8-Dibromo-3,3-bis-decyl-3,4-dihydro-2H-thieno[3,4-b][1,4]dioxepine (a), CDCl$_3$ Solvent peak and water speak were marked by ‘x’, ‘y’ respectively, $^{13}$C NMR spectrum of 6,8-Dibromo-3,3-bis-decyl-3,4-dihydro-2H-thieno[3,4-b][1,4]dioxepine (b), CDCl$_3$ Solvent peak were marked by ‘x’.
Fig. S3. $^1$H NMR spectrum of P1, CHCl$_3$ Solvent and tetramethylsilane peaks were marked by ‘x’, ‘y’, respectively.

Fig. S4. $^1$H NMR spectrum of P2, CHCl$_3$ Solvent and tetramethylsilane peaks were marked by ‘x’, ‘y’, respectively.

Fig. S5. $^1$H NMR spectrum of P3, CHCl$_3$ Solvent and tetramethylsilane peaks were marked by ‘x’, ‘y’, respectively.
**Fig. S6** GPC trace of the polymers P1, P2 and P3.

|   | P1  | P2  | P3  |
|---|-----|-----|-----|
| Mw | 17600 | 19300 | 15200 |
| PDI | 1.69 | 1.75 | 1.88 |

(a) Current Density (mA/cm²)

(b) Current Density (mA/cm²)
After 500 cycles, these polymers could retain 84%, 82% and 87% of their original electroactivity for P1, P2 and P3, respectively.

**Fig. S8.** SEM images of polymeric films P1 (a), P2 (b) and P3 (c).
Fig. S9 Optical transmittance change of P1(a), P2(b), P3(c) at different wavelengths and cycle numbers.

After 500 cycles, for P1 film, the optical contrast remained 87% at 520 nm, 88% at 700 nm and 92% at 1550 nm, respectively. For P2 film, the optical contrast remained 91% at 520 nm, 78% at 700 nm and 95% at 1500 nm after 500 cycles, respectively. While for P3 film, the optical contrast remained 96% at 500 nm, 91% at 710 nm and 93% at 1500 nm after 500 cycles, respectively.
Fig. S10. Electrochromic switching of P2 at 520 nm, 710 nm and 1550 nm with an interval of 10 s, 5 s, 3 s, 2 s, 1 s, respectively.

Fig. S11. Electrochromic switching of P3 at 500 nm, 710 nm and 1550 nm with an interval of 10 s, 5 s, 3 s, 2 s, 1 s, respectively.