Ferrocene-containing poly(fluorenylethynylene)s for nonvolatile resistive memory devices

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Supporting Information

Synthesis of PFcFE1

58% Yield. ¹H NMR (tetrahydrofuran- d_8 , 400 MHz): δ 8.47~8.45 (m, 1H, fluorenyl

H), 8.20~8.07 (m, 1H), 7.86~7.76 (m, 4H), 7.62~7.56 (m, 2H, Ar and vinyl CH),

7.53~7.47 (m, 2H), 7,46~7.38 (m, 2H), 7.35~7.27 (m, 2H), 7.18~7.01 (m, 5H),

6.92~6.88 (m, 1H), 4.83 (brs, 2H, Fc), 4.63~4.59 (m, 2H, Fc), 4.31~4.28 (m, 5H, Fc).

IR (KBr pellet, cm⁻¹): 3032 (C-H stretching, Fc), 2197 (C=C stretching), 1624 (C=C

stretching, Ar), 1588 (C=C stretching, Ar), 1503 (C=C stretching, Ar), 1484 (C=C

stretching, Ar), 1413 (C=C stretching, Fc), 1106 (C-C stretching, Fc), 1001 (C-C stretching, Fc), 817 (C-H bending, Fc), 500 (C-Fe).

Synthesis of PFcFE2

54% Yield. ¹H NMR (tetrahydrofuran-*d*₈, 400 MHz): δ 8.51~8.39 (m, 2H, fluorenyl H), 8.15 (br, 1H, fluorenyl H), 7.84~7.81 (m, 4H), 7.67~7.56 (m, 9H, Ar and vinyl CH), 7.46~7.36 (m, 2H), 4.87~4.83 (m, 2H, Fc), 4.63 (br, 2H, Fc), 4.31~4.30 (m, 5H, Fc). IR (KBr pellet, cm⁻¹): 3057 (C-H stretching, Fc), 2195 (C=C stretching), 1623 (C=C stretching, Ar), 1594 (C=C stretching, Ar), 1482 (C=C stretching, Ar), 1413 (C=C stretching, Fc), 1105 (C-C stretching, Fc), 1001 (C-C stretching, Fc), 814 (C-H bending, Fc), 492 (C-Fe).

Synthesis of PFcFE3

60% Yield. ¹H NMR (tetrahydrofuran-*d*₈, 400 MHz): δ 8.52~8.44 (m, 1H, fluorenyl H), 8.42~8.32 (m, 1H), 8.17~8.11 (m, 1H), 7.86~7.78 (m, 4H), 7.75~7.71 (m, 1H), 7.69~7.63 (m, 1H), 7.61~7.51 (m, 3H, Ar and vinyl CH), 7.40~7.37 (m, 1H), 4.86~4.82 (m, 2H, Fc), 4.63 (brs, 2H, Fc), 4.48~4.41 (m, 2H, CH₂), 4.30~4.29 (m, 5H, Fc), 1.48~1.38 (m, 3H, CH₃). IR (KBr pellet, cm⁻¹): 3077 (C-H stretching, Fc), 2196 (C=C stretching), 1623 (C=C stretching, Ar), 1592 (C=C stretching, Ar), 1482 (C=C stretching, Ar), 1414 (C=C stretching, Fc), 1003 (C-C stretching, Fc), 1001 (C-C stretching, Fc), 815 (C-H bending, Fc), 487 (C-Fe).

Synthesis of PFcFE4

55% Yield. ¹H NMR (tetrahydrofuran-*d*₈, 400 MHz): δ 8.48~8.45 (m, 1H, fluorenyl H), 8.19~8.12 (m, 1H, fluorenyl H), 7.90~7.76 (m, 3H, fluorenyl H), 7.57~7.56 (m, 2H, fluorenyl H and vinyl H), 7.49~7.32 (m, 1H, thiophenyl H), 7.29~7.24 (m, 1H, thiophenyl H), 4.85 (br, 2H, Fc), 4.64 (br, 2H, Fc), 4.31~4.30 (m, 5H, Fc). IR (KBr pellet, cm⁻¹): 3086 (C-H stretching, Fc), 2190 (C=C stretching), 1622 (C=C stretching, Ar), 1596 (C=C stretching, Ar), 1456 (C=C stretching, Ar), 1411 (C=C stretching, Fc), 1103 (C-C stretching, Fc), 1000 (C-C stretching, Fc), 815 (C-H bending, Fc), 488 (C-Fc).



Fig. S1 Size exclusion chromatogram of the synthesized polymers. Eluent: THF, polystyrene standards.



Fig. S2 TGA curves of **PFcFE1**, **PFcFE2**, **PFcFE3** and **PFcFE4** by heating them to 800 °C at a rate of 10 °C min⁻¹ under a nitrogen atmosphere.



Fig. S3 CV curves of PFcFE1, PFcFE2, PFcFE3 and PFcFE4 thin films on glassy carbon electrode.