



was extracted twice with HCl (2 M) and once with saturated NaCl. The organic layer was dried with MgSO<sub>4</sub>, filtered, and concentrated in vacuo to give the product as a brown oil (3.60 g, 85% yield). <sup>1</sup>H NMR (CDCl<sub>3</sub>, ppm): δ 6.92 (d, 1H, *J* = 4 Hz), 6.85 (d, 1H, *J* = 4.5 Hz), 4.72 (s, 2H), 3.69 (s, 3H).

**2-((5-bromothiophen-2-yl)methoxy)-N,N-dimethylethanamine (6).** In a dry flask, NaH (0.76 g, 31.8 mmol) was added to 100 mL of dry THF. The solution was cooled to 0°C. 2-(Dimethylamino)ethanol (2.83 g, 31.8 mmol) was added and the mixture was stirred for 30 min. 5-bromothiophen-2-yl)methyl methanesulfonate (3.60 g, 13.3 mmol) dissolved in 20 mL dry THF was dripped into the solution and let stir at room temperature overnight. The reaction mixture was diluted with dichloromethane and washed three times with 2 M HCl. 4 M NaOH was added to the aqueous layer until a white precipitate was obtained. The aqueous layer was then washed three times with dichloromethane. The combined organic layer was dried with MgSO<sub>4</sub>, evaporated, and the crude product was purified by column chromatography (silica gel; CH<sub>2</sub>Cl<sub>2</sub>/MeOH, 85:15) to give **6** (1.00 g, 28% yield) as a black oil. <sup>1</sup>H NMR (CDCl<sub>3</sub>, ppm): δ 6.90 (d, 1H, *J* = 3.5 Hz), 6.73 (d, 1H, *J* = 3.5 Hz), 3.54 (t, 2H, *J* = 5.5 Hz), 2.51 (t, 2H, *J* = 5.5 Hz), 2.26 (s, 6H). <sup>13</sup>C NMR (120 MHz, CDCl<sub>3</sub>): δ 143.2, 129.5, 126.9, 112.6, 67.9, 58.9, 46.0. ACPI-MS *m/z* calculated for C<sub>9</sub>H<sub>14</sub>BrNOS, 263.00; found, 263.99 (M<sup>+</sup>).

**2-(5-(5-5-5-((2-(Dimethylamino)ethoxy)methyl)tetrathiophene)methoxy)-N,N-dimethylethanamine (7).** In a dry flask that was purged with nitrogen, compound **6** (0.77 g, 2.9 mmol), 5,5'-bis(tributylstannyl)-2,2'-bithiophene (0.98 g, 1.3 mmol), tetrakis(triphenylphosphine)palladium (0.0015 g, 0.013 mmol) was dissolved in 10 mL DMF. The mixture was degassed by three freeze-pump-thaw cycles and then heated to 100°C overnight. The mixture was cooled to room temperature and diluted with dichloromethane. The

organic layer was extracted with saturated  $\text{NaHCO}_3$  three times, dried with  $\text{MgSO}_4$ , and concentrated in vacuo. The crude product was purified by column chromatography (silica gel;  $\text{CH}_2\text{Cl}_2/\text{MeOH}$ , 80/20) to give the desired product (0.26 g, 39%) as a red solid.  $^1\text{H}$  NMR ( $\text{CDCl}_3$ , ppm):  $\delta$  7.07 (m, 4H), 7.04 (d, 2H,  $J = 4$  Hz), 6.92 (d, 2H,  $J = 3.5$  Hz), 4.69 (t, 4H,  $J = 6.0$  Hz), 2.56 (t, 4H,  $J = 5.5$  Hz), 2.30 (s, 12H).  $^{13}\text{C}$  NMR not possible due to poor solubility. MALDI-TOF MS  $m/z$  calculated for  $\text{C}_{27}\text{H}_{32}\text{N}_2\text{O}_2\text{S}_4$ , 533.81; found, 533.89 ( $\text{M} + \text{H}^+$ ).

**Cationic quaterthiophene (2).** Compound **7** (0.1 g 0.19 mmol) was dissolved in 20 mL of dry THF. A 2 M solution of methylbromide in *t*-butyl methyl ether (5 mL, 10 mmol) was added and the mixture was stirred for 1 day to room temperature. During the stirring a yellow-orange suspension was formed. The suspension was filtered to give the desired compound quantitatively as a yellow-orange solid.  $^1\text{H}$  NMR ( $\text{DMSO}-d_6$ , ppm):  $\delta$  7.32 (d, 2H,  $J = 3.5$  Hz), 7.29 (d, 2H,  $J = 4.0$  Hz), 7.26 (d, 2H,  $J = 3.5$  Hz), 7.09 (d, 2H,  $J = 4.0$  Hz), 4.73 (s, 4H), 3.90 (t, 4H,  $J = 5.0$  Hz), 3.60 (t, 4H,  $J = 5.0$  Hz), 3.13 (s, 18H).  $^{13}\text{C}$  NMR ( $\text{DMSO}-d_6$ , ppm):  $\delta$  140.5, 135.9, 136.1, 135.4, 128.9, 126.0, 125.8, 124.6, 67.1, 63.9, 53.7. ESI-MS  $m/z$  calculated for  $\text{C}_{28}\text{H}_{38}\text{N}_2\text{O}_2\text{S}_4^{2+}$  281.09; found, 281.49 ( $\text{M}^{2+}$ ).