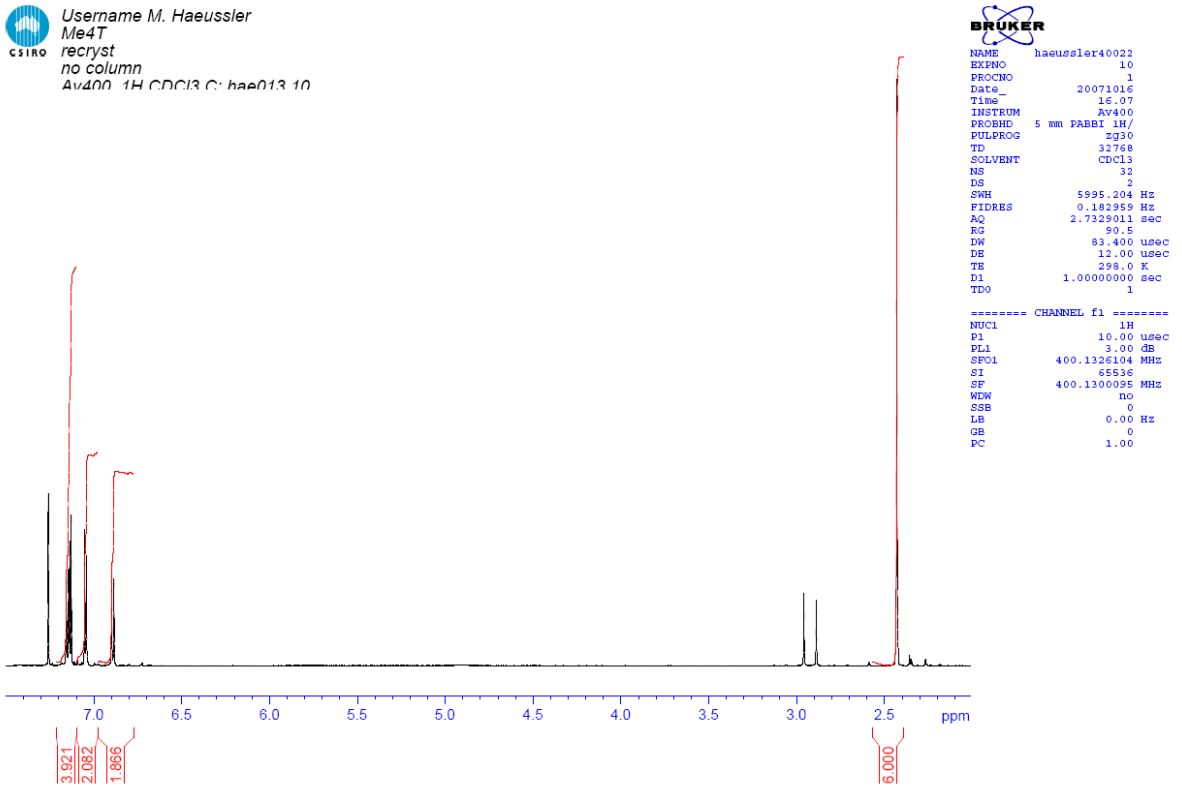
Block copolymers containing organic semiconductor segments by RAFT polymerization

Ming Chen, Matthias Häussler, Graeme Moad, Ezio Rizzardo

Supplementary Material (NMR Spectra)

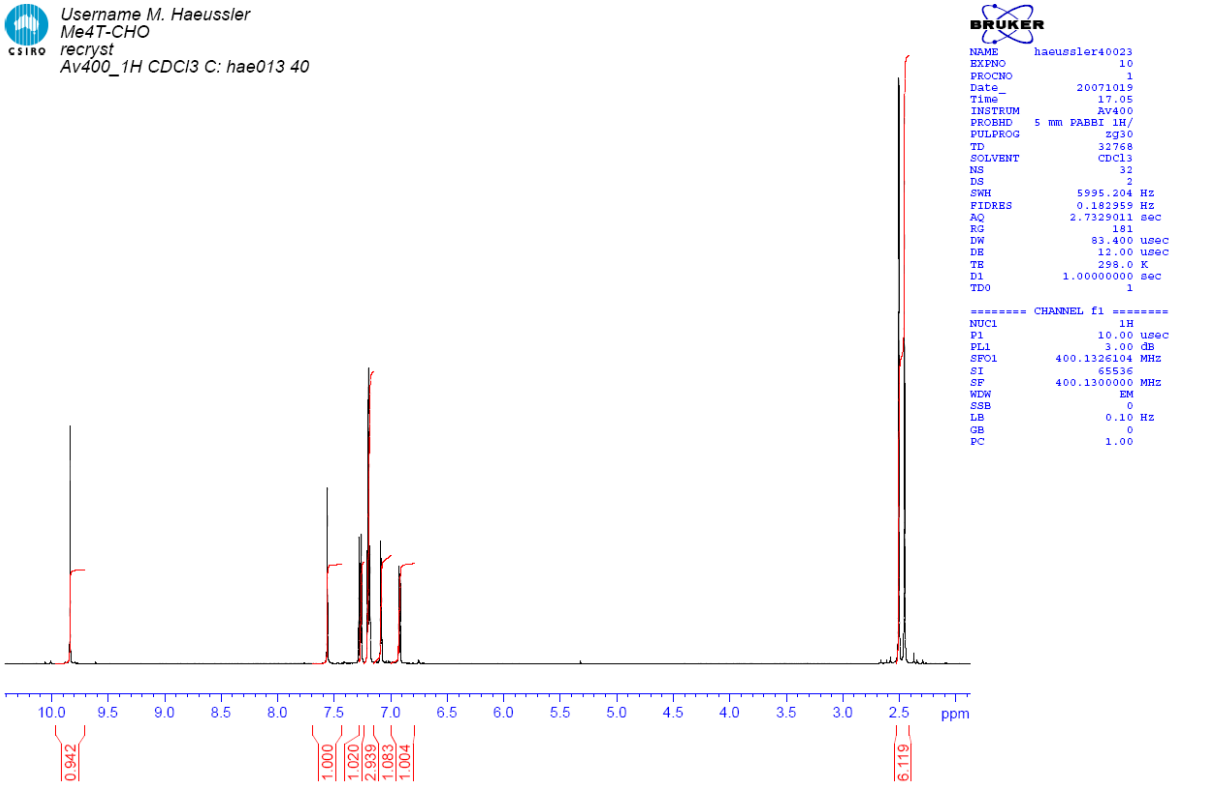
5

^{1}H NMR ($CDCl_3$): δ 7.15 (d, J = 5.2 Hz, 2H, 5,5'''-*H*), 7.13 (d, J = 3.8 Hz, 2H, 3',4''-*H*), 7.05 (d, 2H, J = 3.8 Hz, 4',3''-*H*), 6.89 (d, J = 5.2 Hz, 2 H, 4,4'''-*H*), 2.43 (s, 6H, -CH_3). Signals at ca. 2.8 and 3.0 ppm are due to *N*,*N*-dimethylformamide (DMF).



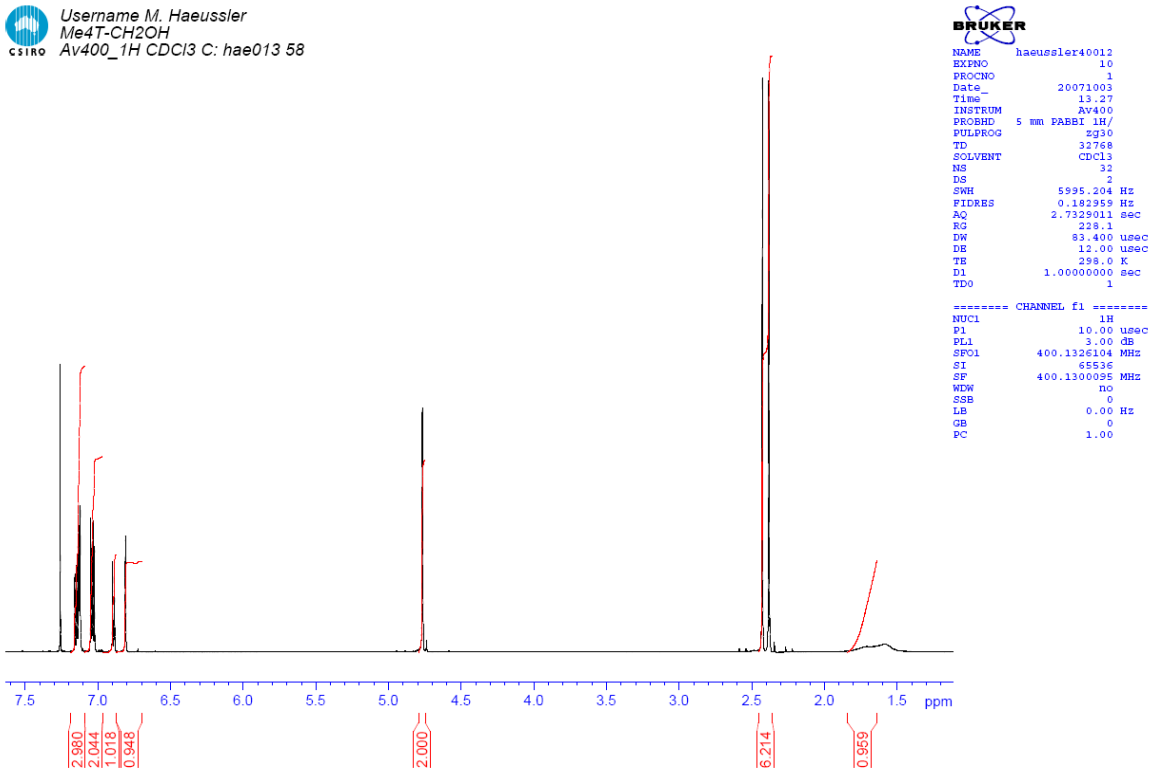
6

^{1}H NMR ($CDCl_3$): δ 9.81 (s, 1H, -CHO), 7.54 (s, 1H, 3-*H*), 7.24 (d, J = 3.8 Hz, 1H, 3'-H), 7.17 (m, 3H, 4',4'',5'''-*H*), 7.06 (d, J = 3.9 Hz, 1H, 3''-*H*), 6.90 (d, 1H, J = 5.1 Hz, 4'''-*H*), 2.48 (s, 3H, 4-CH_3), 2.43 (s, 3H, 3'''-CH_3).



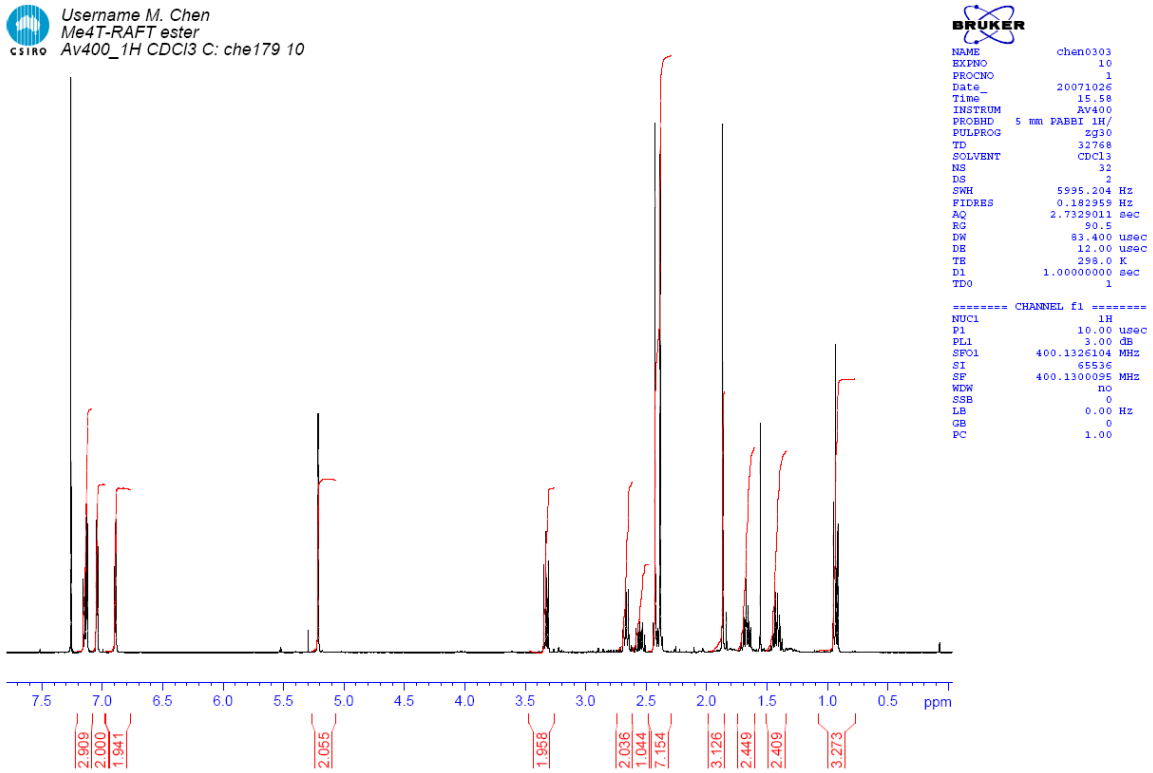
7

^{1}H NMR ($CDCl_3$): δ 7.15 (d, J = 5.2 Hz, 1H, 5’’’-H), 7.13 (dd, J = 3.8 Hz, 2H, 3’,4’’-*H*), 7.05 (d, 1H, J = 3.8 Hz, 4’-*H*), 7.02 (d, 1H, J = 3.8 Hz, 3’’-*H*), 6.89 (d, J = 5.2 Hz, 1H, 4’’’-*H*), 6.81 (s, 1H, 3-*H*), 4.77 (s, 2H, -OCH_2), 2.43 (s, 3H, 3’’’-CH_3), 2.38 (s, 3H, 4-CH_3)

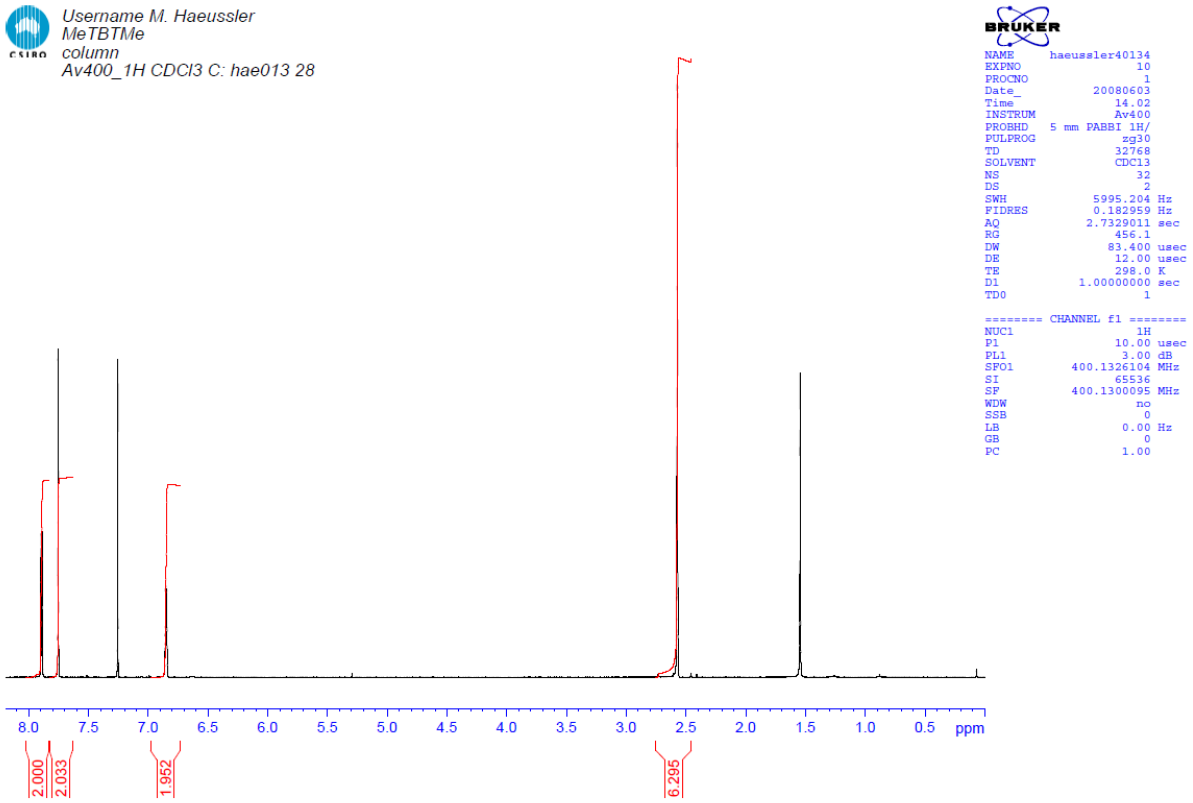


8

^{1}H NMR ($CDCl_3$): δ 7.15 (d, J = 5.2 Hz, 1H, 5'''-H), 7.13 (dd, J = 3.8 Hz, 2H, 3',4''-*H*), 7.05 (dd, 2H, J = 3.8 Hz, 4',3''-*H*), 6.89 (d, J = 5.2 Hz, 1H, 4'''-*H*), 6.88 (s, 1H, 3-*H*), 5.22 (s, 2H, -OCH_2), 3.33 (t, 2H, J = 7.5 Hz, -SCH_2), 2.67 (m, 2H, C(O)CH_2), 2.56 (m, 1H, CH_2CMeCN), 2.43 (s, 3H, 3'''-CH_3), 2.41 (m, 1H, CH_2CMeCN), 2.38 (s, 3H, 4-CH_3), 1.87 (s, 3H, C(CN)CH_3), 1.68 (m, 2H, SCH_2CH_2), 1.43 (m, 2H, $SCH_2CH_2CH_2$), 0.93 (t, 3H, J = 7.5 Hz, $SCH_2CH_2CH_2CH_3$).

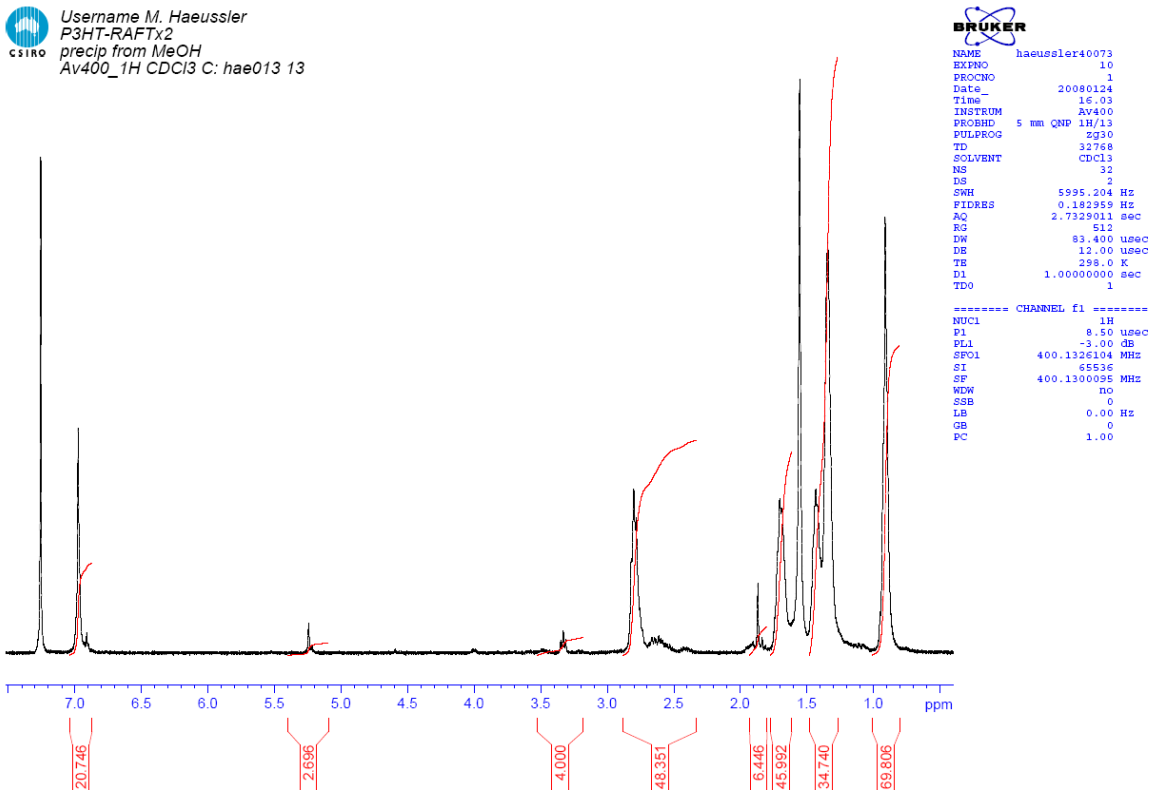


1H NMR ($CDCl_3$): δ 7.89 (d, 3J = 3.6 Hz, 2H; CH), 7.76 (s, 2H; CH), 6.85 (dd, 3J = 3.6, Hz, 4J = 1.1 Hz, 2H; CH), 2.58 (s, 6H; CH_3).



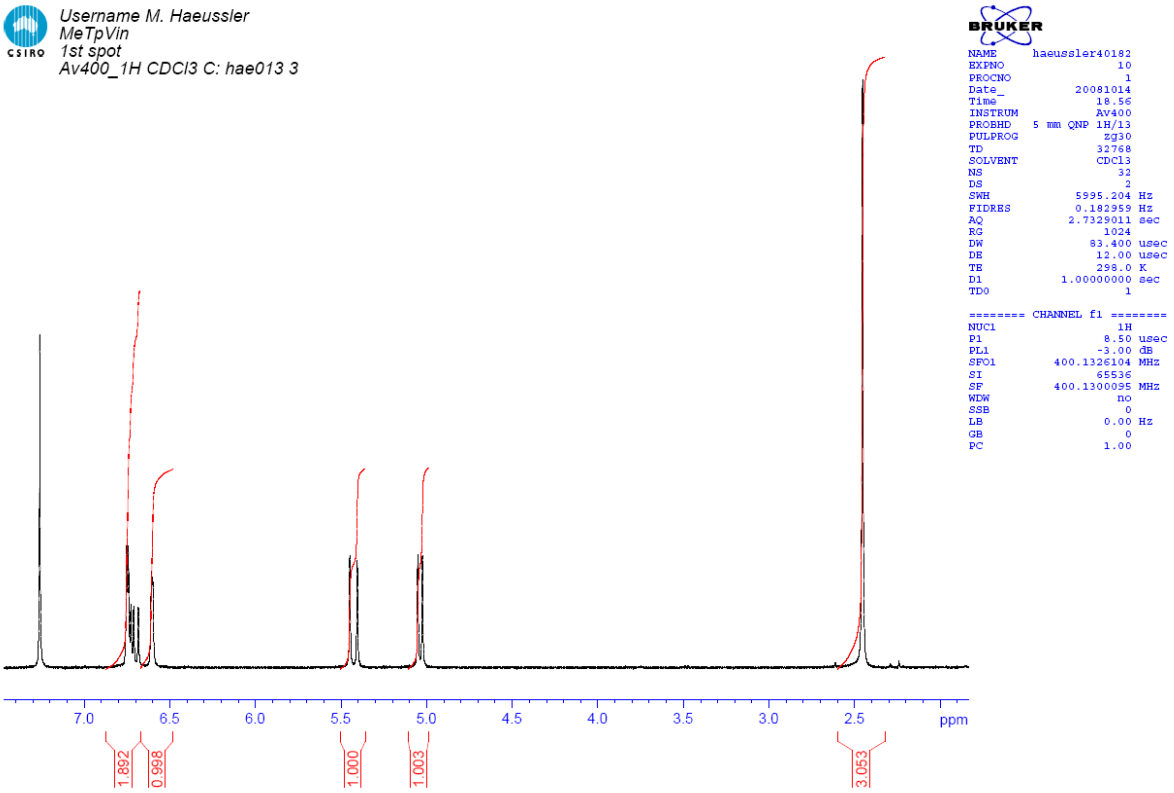
17

^{1}H NMR ($CDCl_3$): δ 6.89 (s, Tp-*H*), 5.25 (s, -OCH_2), 3.33 (t, -SCH_2), 2.79 (Tp$CH_2C_5H_{11}$), 2.67 (m, $C(O)CH_2$), 2.56 (m, CH_2CMeCN), 2.41 (m, CH_2CMeCN), 1.87 (s, $C(CN)CH_3$), 1.70 (m, $TpCH_2CH_2C_4H_9$ and SCH_2CH_2),1.43 (m, $TpC_2H_4C_3H_6CH_3$ and $SC_2H_4CH_2$), 0.93 (m, Tp-C_5H_{11}-CH_3 and $SCH_2CH_2CH_2CH_3$) (Tp = thiophene).



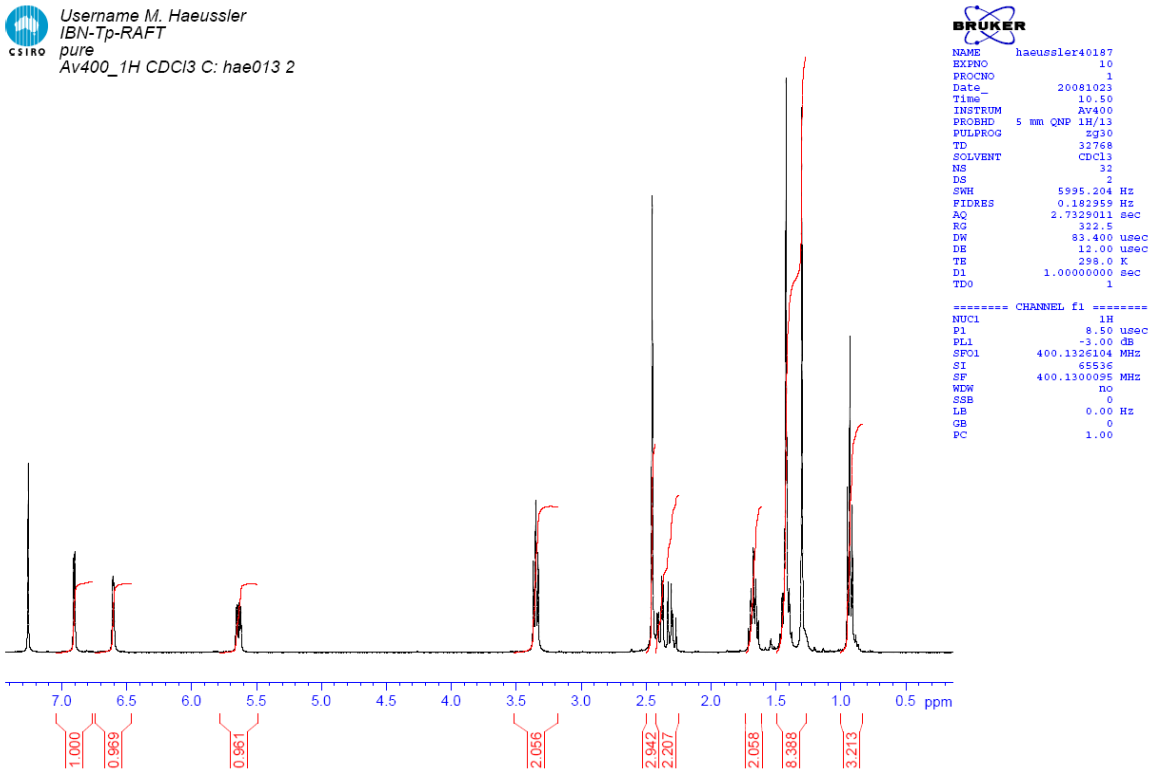
20

^{1}H NMR ($CDCl_3$): δ 6.74 (d, 1H, J = 3.5 Hz, 3 Tp-H), 6.72 (dd, 1H, J = 17.1 and 10.8 Hz, Tp-CH=), 6.60 (d, 1H, J = 2.5 Hz, 2 Tp-H), 5.43 (d, 1H, J = 17.3 Hz, =C*H*H), 5.04 (d, 1H, J = 10.8 Hz, =CH*H*), 2.45 (s, 3H, CH_3) (Tp = thiophene).



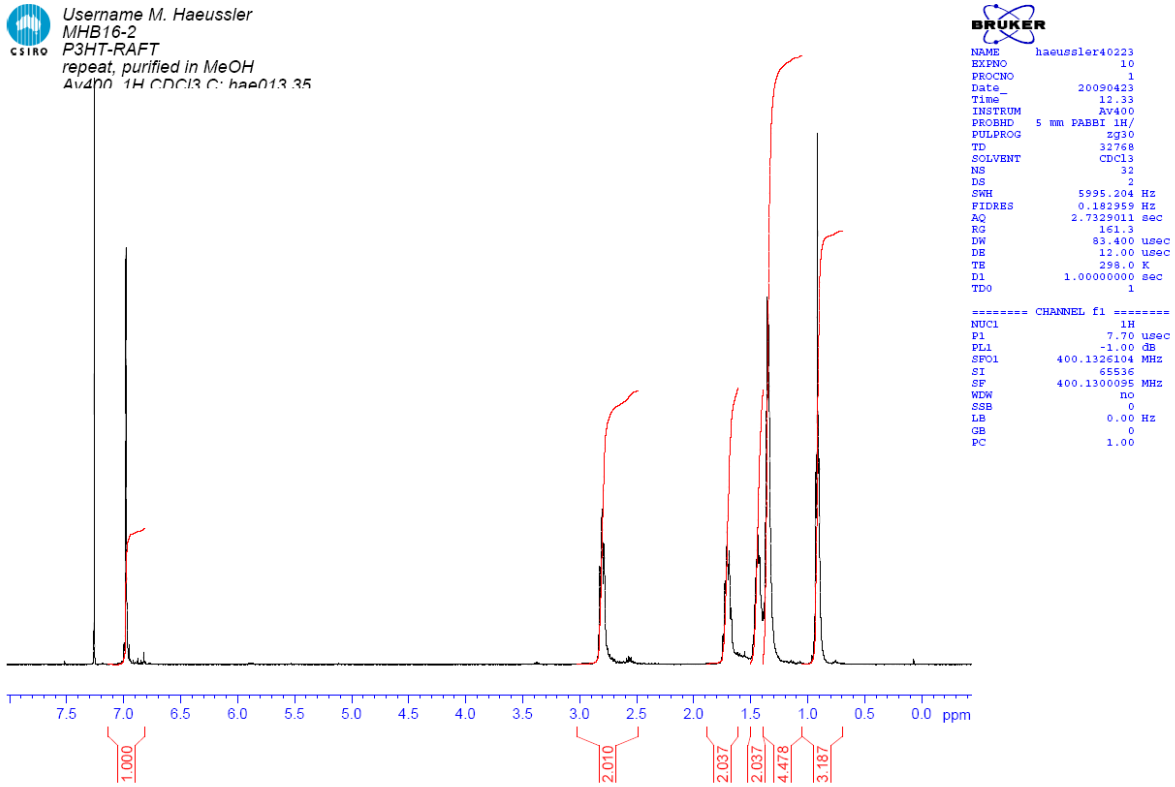
21

^{1}H NMR ($CDCl_3$): δ 6.91 (d, 1H, J = 3.4 Hz, 4 Tp-H), 6.60 (d, 1H, 3.4 Hz, 3 Tp-H), 5.64 (dd, 1H, J = 10.4 and 4.3 Hz, Tp-C*H*CH_2), 3.35 (t, 2H, J = 7.35, S-CH_2), 2.45 (s, 3H, Tp-CH_3), 2.33 (m, 2H, Tp-CHC*H*$_2$), 1.67 (m, 2H, S-CH_2C*H*$_2$), 1.42 (s, 6H, C(CN)(CH_3)$_2$), 1.30 (s, 2H, C*H*$_2$$CH_3$), 0.93 (t, 3H, J = 7.3 Hz, CH_2C*H*$_3$) (Tp = thiophene).



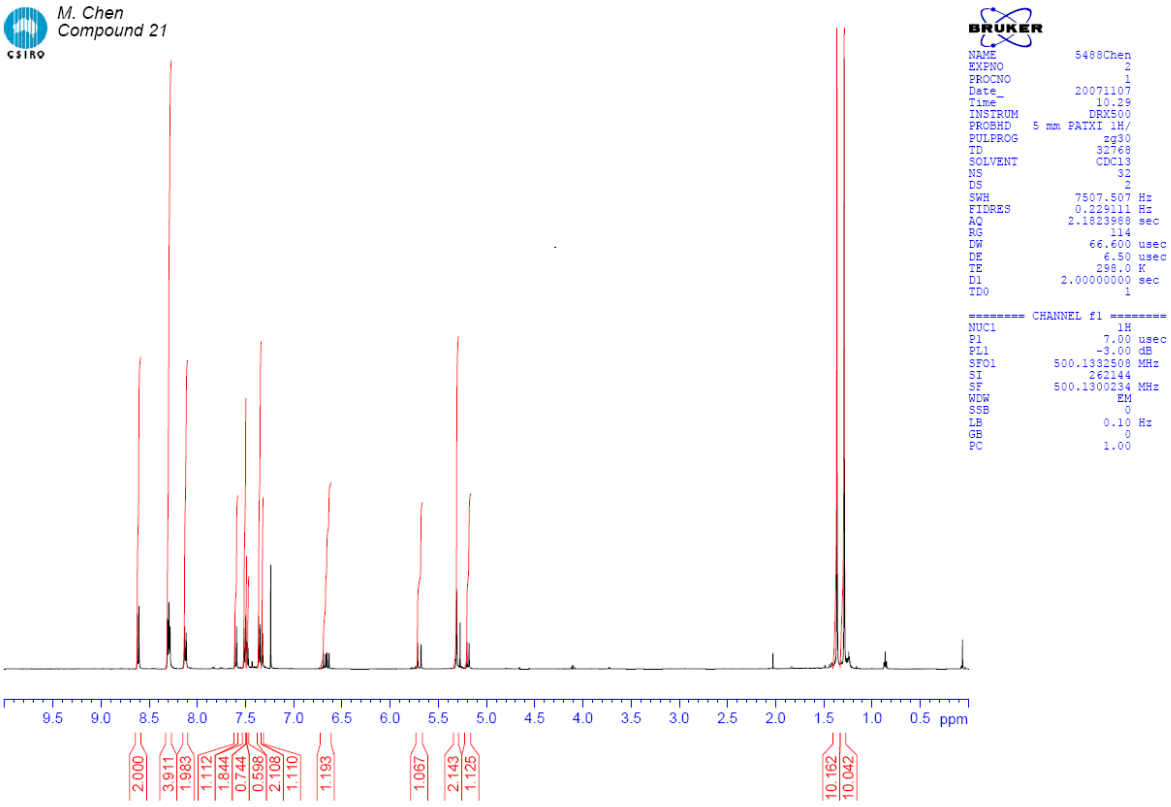
24

^{1}H NMR ($CDCl_3$): δ 6.98 (s, Tp-H), 5.88 (m, Tp-C*H*-S), 3.38 (m, S-CH_2C$_3$H$_7$), 2.8 (t, Tp-CH_2), 2.55 (t, Br-Tp-CH_2), 1.71 (m, Tp-CH_2CH_2), 1.44 and 1.35 (m, CH_2 of hexyl and butyl groups), 0.94 (m, CH_3 of hexyl and butyl groups) (Tp = thiophene). Expansions of this NMR are shown in Figure 1 of paper.



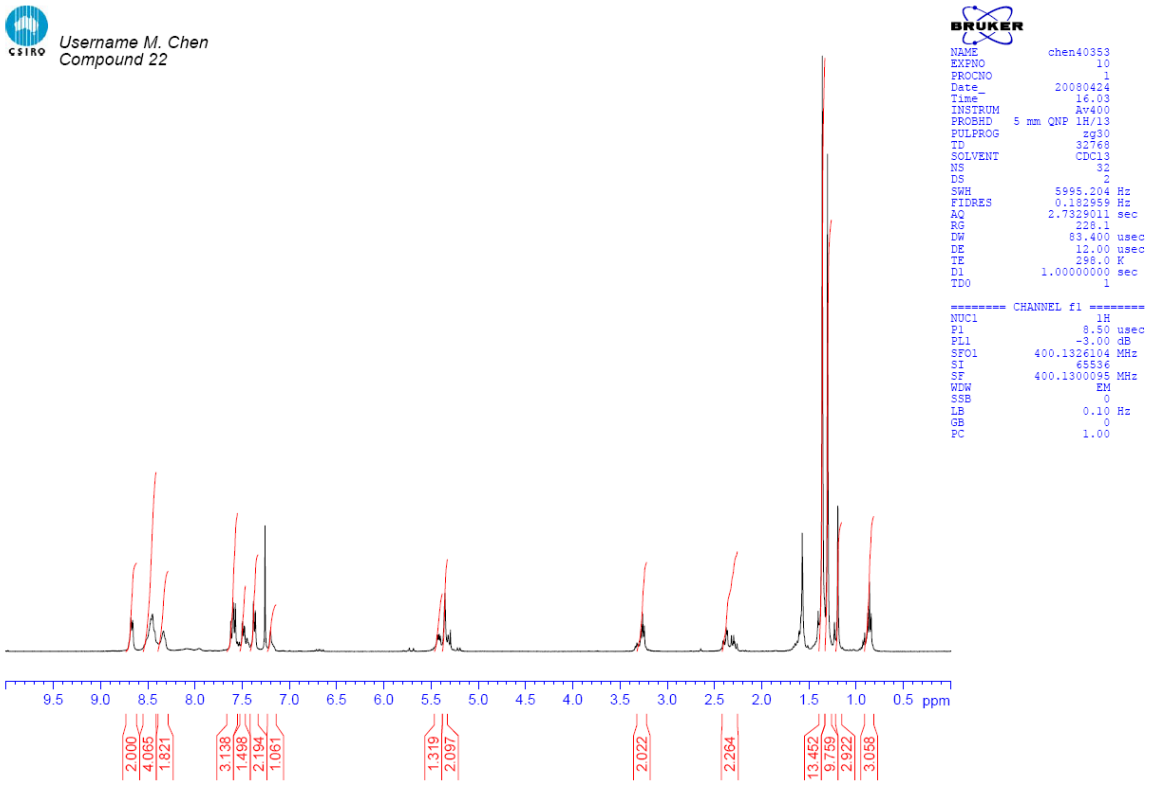
29

^{1}H NMR (CDC1$_3$): δ 8.61 (d, 2H, J= 8.0 Hz, perylene-H), 8.30 (dd, 4H, J= 8.0, 5.3 Hz, perylene -H), 8.12 (d, 2H, J=8.2 Hz, perylene -H), 7.60 (d, 1H, J=8.7 Hz, Ph-H), 7.47-7.53 (m, 3H, Ph-H), 7.36 (d, 2H, J=8.2, Ph-H), 7.33 (d, 1H, J = 2.3 Hz, Ph-H), 6.73 (dd, 1H, J=17.6 and 10.9 Hz, =C*H*H), 5.76 (d, 1H, J=17.6 Hz, =CH*H*), 5.31 (s, 2H, St-CH_2-N-), 5.25 (d, 1H, J=10.9 Hz, C*H*=CH$_2$), 1.36 (s, 9H, -C(CH_3)$_3$), 1.29 (s, 9H, -C(CH_3)$_3$).



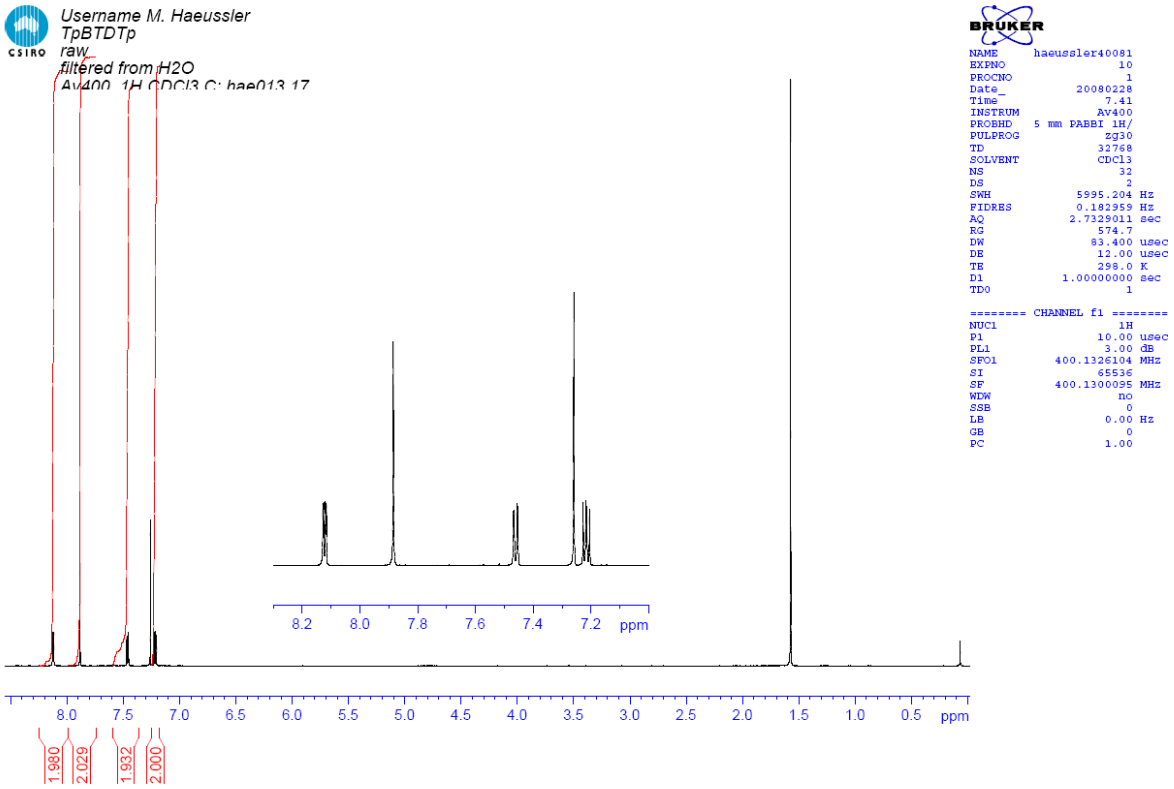
30

^{1}H NMR (CDC1$_3$): δ 8.67 (b, 2H, perylene-H), 8.46 (b, 4H, perylene-H), 8.33(b, 2H, perylene-H), 7.20 (b, 1H, Ph-H), 5.42 (m, 1H, -S-C*H*(Ph)-CH2-), 5.35 (s, 2H, Ph-C*H*$_2$-N-), 3.26 (t, 2H, J=7.45 Hz, -CH$_2$-C*H*$_2$-S-), 2.34 (m, 2H, -CH(Ph)-C*H*$_2$-C-), 1.36 (s, 9H, -C(C*H*$_3$)$_3$), 1.34 (s, 6H,–C(CN)(C*H*$_3$)$_2$), 1.29 (s, 9H, -C(C*H*$_3$)$_3$), 0.86 (t. 3H, J=7.3 Hz, -CH$_2$C*H*$_3$).



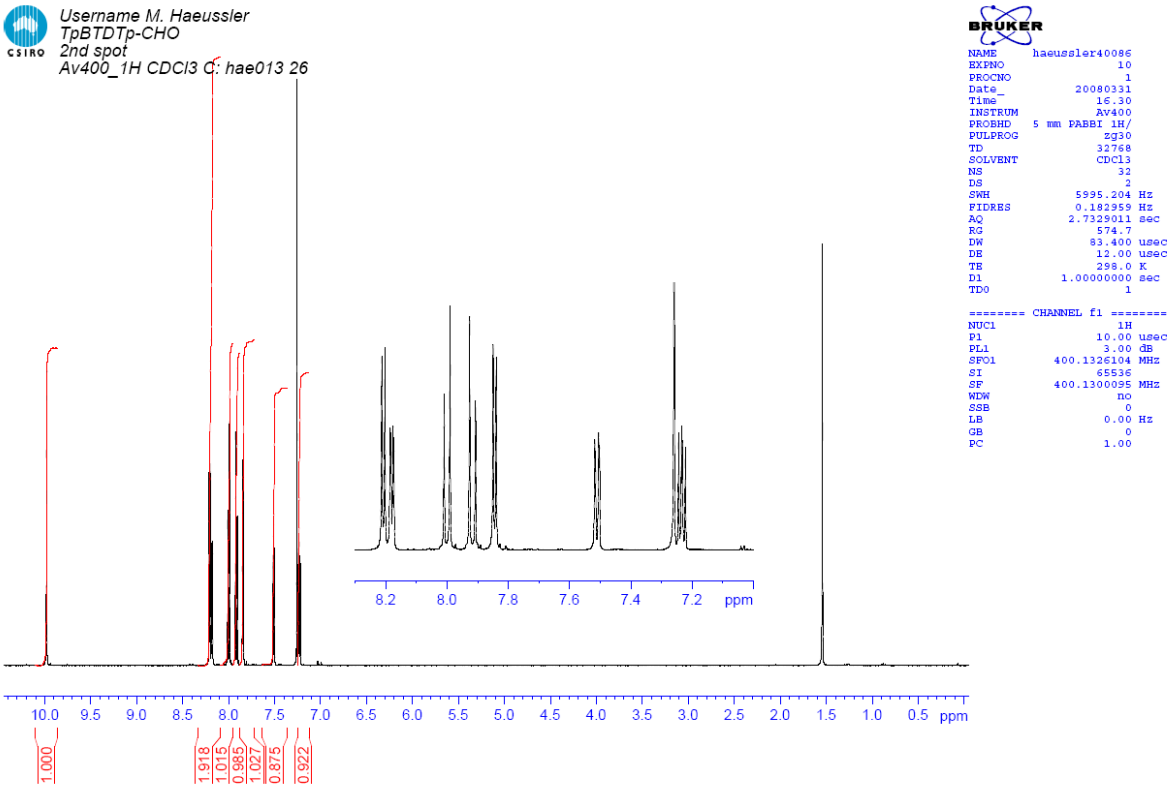
11

^{1}H NMR ($CDC1_3$): δ 8.12 (d, 2H, J = 3.8 Hz, 3,3' Tp-H), 7.88 (s, 2H, 5,6 B-H), 7.46 (d, 2H, J= 5.1 Hz, 5,5' Tp-H), 7.21 (dd, 2H, J= 5.1, 3.8 Hz, 4,4' Tp-H) (Tp = thiophene).



S1

^{1}H NMR ($CDC1_3$): δ 9.98 (s, 1H, -CHO), 8.21 (d, 1H, J= 4.1 Hz, 4 Tp-H), 8.18 (d, 1H, J= 3.8 Hz, 3’ Tp-H), 8.0 (d, 1H, J= 7.7 Hz, 5 B-H), 7.92 (d, 1H, J= 7.7 Hz, 6 B-H), 7.85 (d, 1H, J= 4.1 Hz, 3 Tp-H), 7.51 (d, 1H, J= 5.1 Hz, 5’ Tp-H), 7.23 (dd, 1H, J= 5.1 and 3.8 Hz, 4’ Tp-H) (Tp = thiophene, B= benzothidiazole).



S2

^{1}H NMR ($CDC1_3$): δ 8.12 (d, 1H, J= 3.8 Hz, 4 Tp-H), 7.98 (d, 1H, J=3.8 Hz, 3' Tp-H), 7.88 (d, 1H, J=7.6 Hz, 5 B-H), 7.84 (d, 1H, J=7.6 Hz, 6 B-H), 7.46 (d, 1H, J=5.2 Hz, 5' Tp-H), 7.21 (dd, 1H, J=5.1, 3.8 Hz, 4' Tp-H), 7.11 (d, 1H, J=3.8 Hz, 3 Tp-H), 4.91 (s, 2H, -OCH_2) (Tp = thiophene, B= benzothidiazole).

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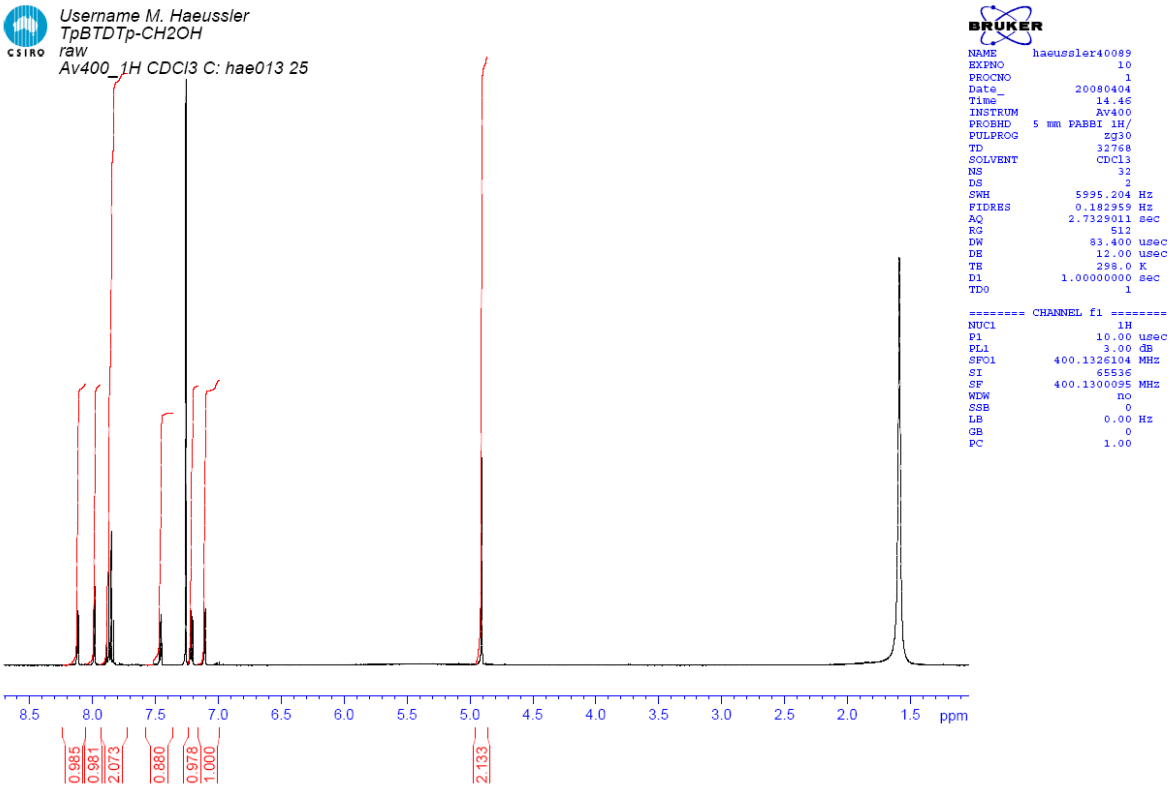

32

^{1}H NMR ($CDC1_3$): δ 8.12 (d, 1H, J=3.5 Hz, 4 Tp-H), 7.98 (d, 1H, J=3.8 Hz, 3' Tp-H), 7.88 (d, 1H, J=7.6 Hz, 5 B-H), 7.84 (d, 1H, J=7.6 Hz, 6 B-H), 7.46 (d, 1H, J=5.2 Hz, 5' Tp-H), 7.42 (d, 2H, J=8.1, 3 Ph-H), 7.42 (d, 2H, J=8.1 Hz, 2 Ph-H), 7.22 (dd, 1H, J=5.2, 3.8 Hz, 4' Tp-H), 7.10 (d, 1H, J=3.5 Hz, 3 Tp-H), 6.73 (dd, 1H, J=17.6 and 10.9 Hz, =C*H*H), 5.76 (d, 1H, J=17.6 Hz, =CH*H*), 5.25 (d, 1H, J=10.9 Hz, C*H*=CH_2), 4.77 (s, 2H, -OCH_2Tp), 4.62 (s, 2H, -OCH_2Ph) (Tp = thiophene, B= benzothidiazole).

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