Supporting Information

Promoting Uniform Zinc Coatings through the Use of Quaternary Ammonium Salts based on Phthalimide as Electroplating Additives

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1. ^{1}H NMR, ^{13}C NMR and mass spectral information of the compound

Compound PI1: yield: 58% ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.12-9.04 (m, 2H), 8.61 (tt, J = 7.8, 1.4 Hz, 1H), 8.20-8.12 (m, 2H), 7.90 – 7.81 (m, 4H), 4.63 (t, J = 7.5 Hz, 2H), 3.62 (t, J = 6.8 Hz, 2H), 2.05 – 1.88 (m, 2H), 1.70 – 1.53 (m, 2H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 151.46, 145.82, 134.90, 125.90, 123.51, 122.38, 37.27.

Fig. S1 ^{1}H NMR (DMSO-d_6) of the compound PI1

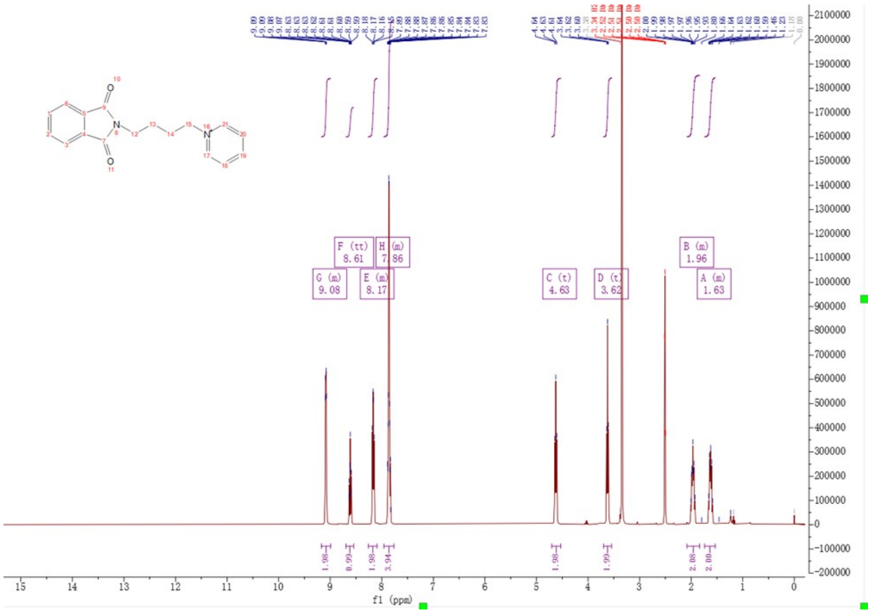
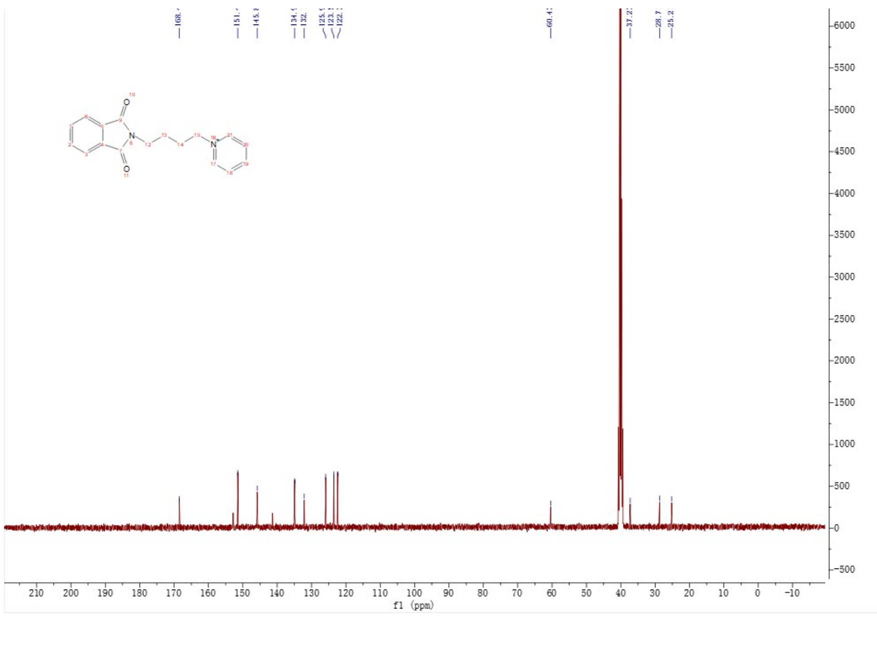


Fig. S2 ^{13}C NMR (DMSO-d_6) of the compound PI1



Compound PI2: yield: 62% ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.37 – 9.04 (m, 2H), 8.98 – 8.78 (m, 2H), 8.74 – 8.52 (m, 2H), 8.20 – 7.95 (m, 2H), 7.92 – 7.68 (m, 4H), 4.67 (t, J = 7.4 Hz, 2H), 3.64 (t, J = 6.8 Hz, 2H), 2.16 – 1.86 (m, 2H), 1.67 (p, J = 6.9 Hz, 2H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 168.47, 152.79, 151.44, 145.80, 141.32, 134.88, 125.88, 123.49, 122.36, 60.41, 37.25, 28.69, 25.19.

Fig. S3 ^{1}H NMR (DMSO-d_6) of the compound PI2

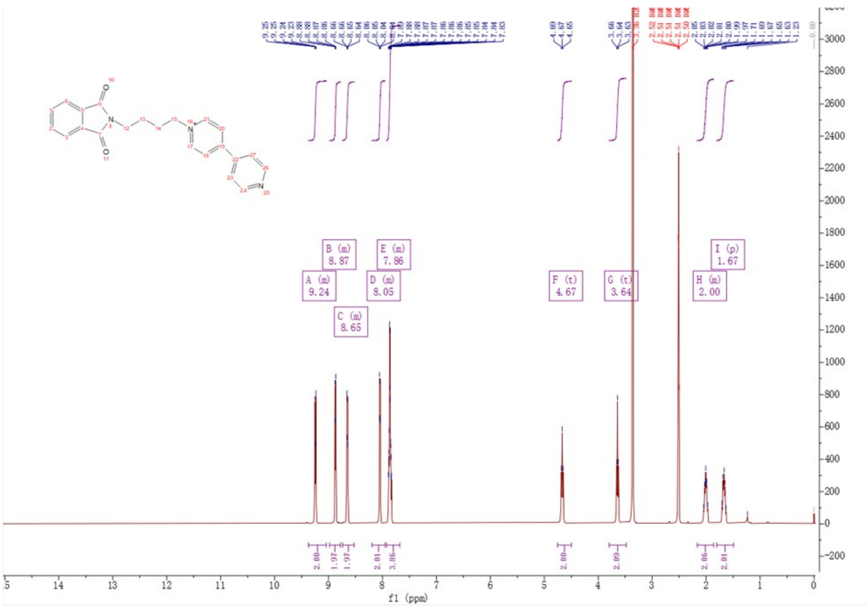
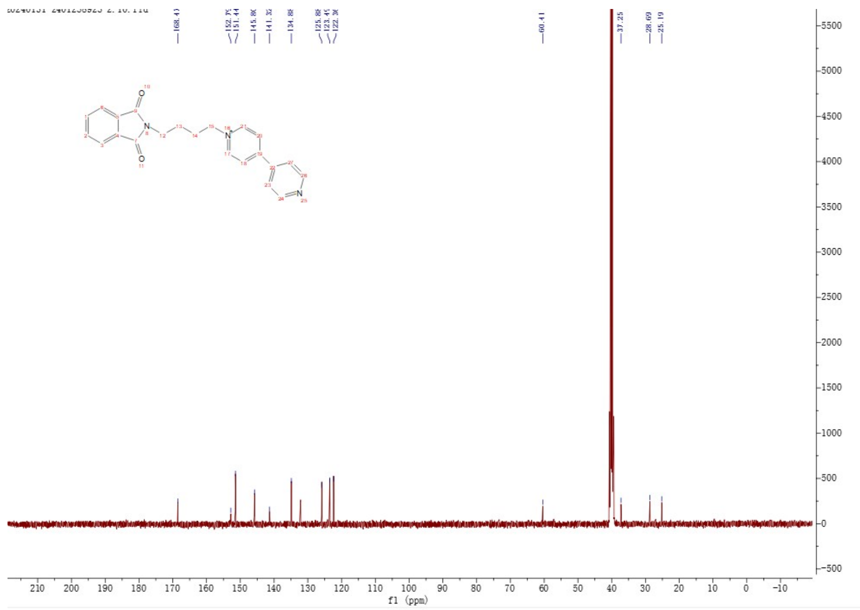


Fig. S4 ^{13}C NMR (DMSO-d_6) of the compound PI2



Compound PI3: yield: 57% ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.55 (dd, *J* = 5.8, 1.5 Hz, 1H), 9.29 (d, *J* = 8.3 Hz, 1H), 8.66 (d, *J* = 9.0 Hz, 1H), 8.49 (dd, *J* = 8.3, 1.5 Hz, 1H), 8.29 – 8.16 (m, 2H), 8.08 – 8.03 (m, 1H), 7.84 (qd, *J* = 4.5, 2.4 Hz, 4H), 5.08 (t, *J* = 7.6 Hz, 2H), 3.64 (t, *J* = 6.8 Hz, 2H), 2.06 – 1.97 (m, 2H), 1.76 (p, *J* = 6.9 Hz, 2H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 168.47, 150.23, 147.94, 136.11, 134.88, 132.09, 131.21, 130.35, 123.49, 122.64, 119.44, 57.38, 37.31, 27.43, 25.46.

Fig. S5 ^{1}H NMR (DMSO-d_6) of the compound PI3

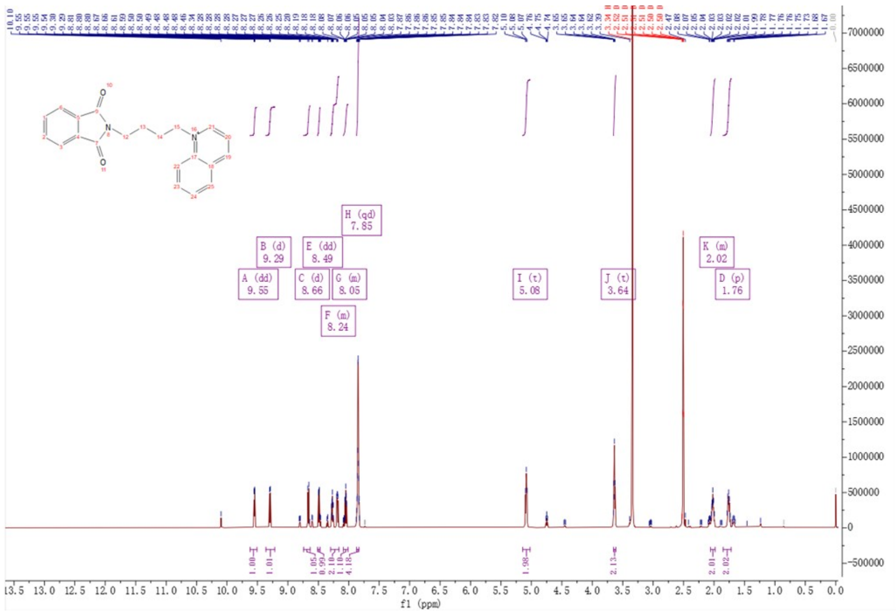
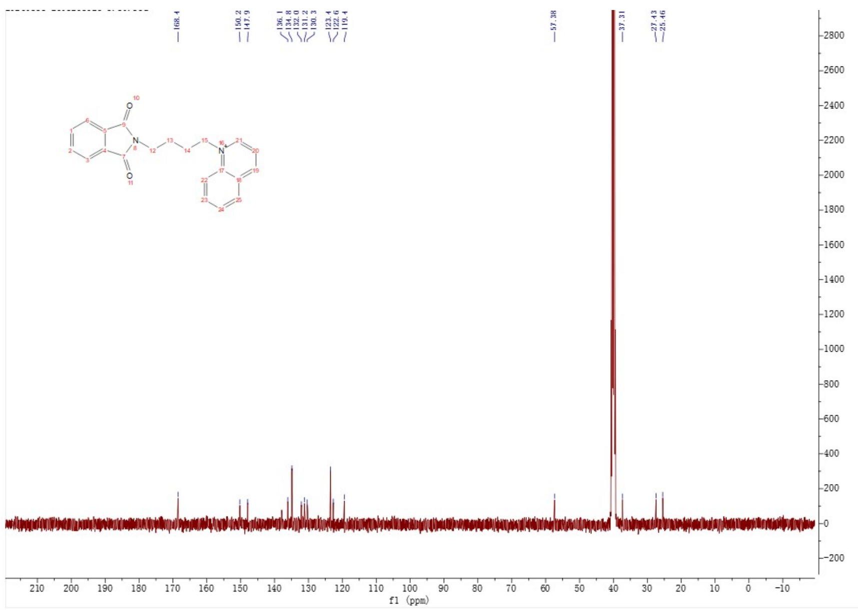


Fig. S6 ^{13}C NMR (DMSO-d_6) of the compound PI3



Compound PI4: yield: 55% ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.48-9.15 (m, 4H), 8.92-8.69 (m, 4H), 7.97-7.78 (m, 4H), 4.72 (t, J = 7.4 Hz, 2H), 4.46 (s, 3H), 3.65 (t, J = 6.8 Hz, 2H), 2.04 (td, J = 14.3, 6.7 Hz, 2H), 1.82-1.56 (m, 2H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 168.50, 147.12, 146.28, 134.94, 132.14, 127.06, 126.57, 123.53, 60.95, 48.57, 37.26, 28.80, 25.24.

Fig. S7 ^{1}H NMR (DMSO-d_6) of the compound PI4

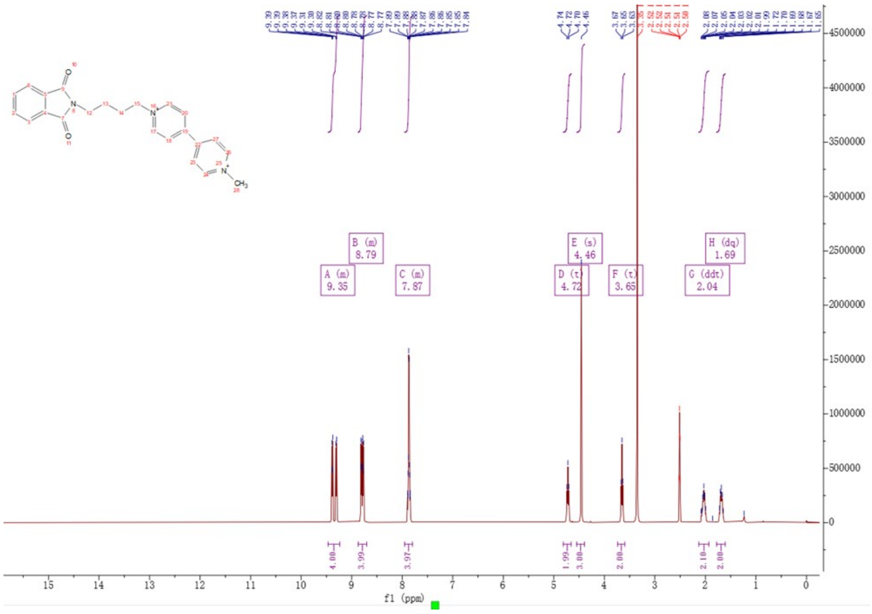
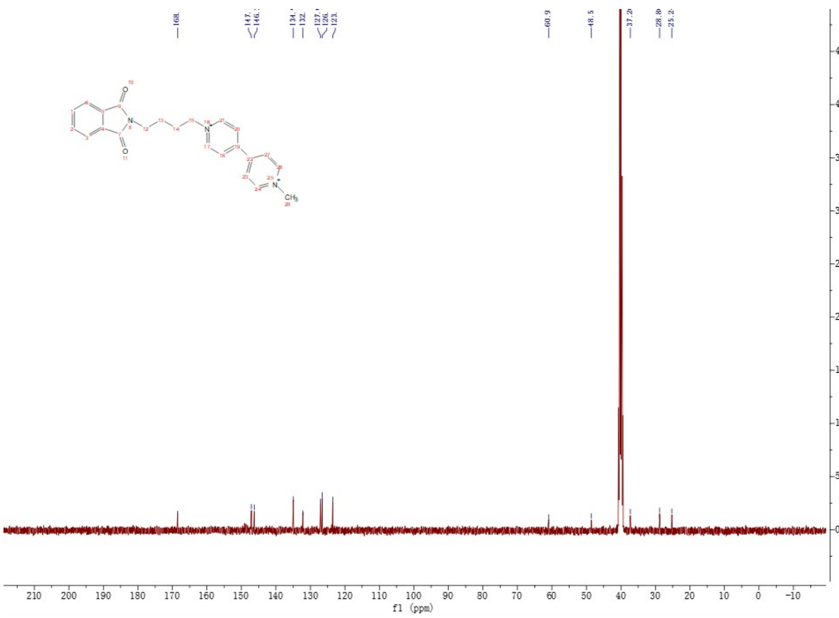


Fig. S8 ^{13}C NMR (DMSO-d_6) of the compound PI4



Compound PI5: yield: 52% ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.49-9.14 (m, 4H), 9.03-8.62 (m, 4H), 8.09-7.67 (m, 4H), 4.72 (t, J = 7.4 Hz, 2H), 4.46 (s, 3H), 3.65 (t, J = 6.8 Hz, 2H), 2.04 (td, J = 14.3, 6.7 Hz, 2H), 1.82-1.56 (m, 2H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 168.50, 147.12, 146.28, 134.94, 132.14, 127.06, 126.57, 123.53, 60.95, 48.57, 37.26, 28.80, 25.24.

Fig. S9 ^{1}H NMR (DMSO-d_6) of the compound PI5

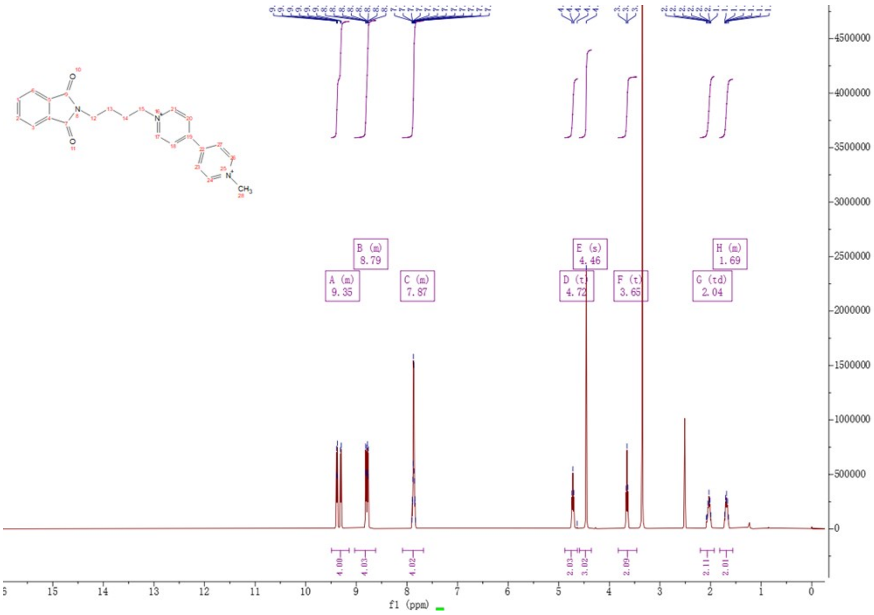


Fig. S10 ^{13}C NMR (DMSO-d_6) of the compound PI5