Electronic supplementary information for

Synthesis, evaluation and thermodynamics of a 1H-benzo-imidazole phenanthroline derivative as a novel inhibitor for mild steel against acidic corrosion

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Table S1 Electrochemical data obtained from potentiodynamic polarization curves of mild steel in 1.0 M HCl at 25 ℃, 50 ℃, 70 ℃ and 90 ℃ with the concentrations of inhibitor.

Temp. (℃)	*C* (mM)	E_{corr} (mV)	i_{corr} (mA·cm^{-2})	b_c (mV·dec^{-1})	b_a (mV·dec^{-1})	C_R (mg·cm^{-2}·h^{-1})	θ	I_E (%)
25	0	-452	14.60×10^{-2}	-142	69	15.3×10^{-2}	-	-
	0.01	-456	3.05×10^{-2}	-110	71	3.2×10^{-2}	0.791	79.1
	0.05	-439	2.70×10^{-2}	-129	69	2.8×10^{-2}	0.815	81.5
	0.1	-422	2.36×10^{-2}	-114	64	2.5×10^{-2}	0.838	83.8
	0.5	-409	2.33×10^{-2}	-92	66	2.4×10^{-2}	0.840	84.0
	1.0	-406	2.31×10^{-2}	-89	60	2.4×10^{-2}	0.842	84.2
50	0	-411	10.72×10^{-1}	-135	61	11.2×10^{-1}	-	-
	0.01	-475	2.37×10^{-1}	-88	99	2.5×10^{-1}	0.779	77.9
	0.05	-485	2.18×10^{-1}	-92	111	2.3×10^{-1}	0.797	79.7
	0.1	-487	2.07×10^{-1}	-81	91	2.2×10^{-1}	0.807	80.7
	0.5	-476	2.01×10^{-1}	-78	84	2.1×10^{-1}	0.813	81.3
	1.0	-472	1.89×10^{-1}	-99	106	2.0×10^{-1}	0.824	82.4
70	0	-441	5.23	-137	94	54.7×10^{-1}	-	-
	0.01	-439	1.08	-76	96	11.3×10^{-1}	0.793	79.3
	0.05	-489	0.86	-114	133	9.0×10^{-1}	0.836	83.6
	0.1	-483	0.62	-107	105	6.5×10^{-1}	0.881	88.1
	0.5	-506	0.55	-86	88	5.7×10^{-1}	0.895	89.5
	1.0	-485	0.50	-89	92	5.2×10^{-1}	0.904	90.4
90	0	-436	26.55	-65	73	277.4×10^{-1}	-	-
	0.01	-445	4.79	-67	68	50.1×10^{-1}	0.820	82.0
	0.05	-442	3.30	-69	72	34.5×10^{-1}	0.876	87.6
	0.1	-477	1.95	-70	75	19.8×10^{-1}	0.927	92.7
	0.5	-471	1.13	-76	87	11.8×10^{-1}	0.957	95.7
	1.0	-443	0.63	-66	78	6.6×10^{-1}	0.976	97.6

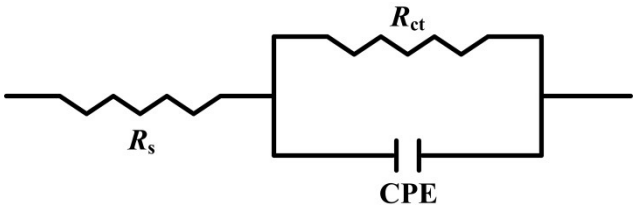

Fig. S1 Equivalent circuit used for modeling EIS data of mild steel in 1.0 M HCl.

Table S2 Electrochemical data obtained from Nyquist plots of mild steel in 1.0 M HCl at 25 ℃, 50 ℃, 70 ℃ and 90 ℃ with the concentrations of inhibitor.

Temp. (℃)	*C* (mM)	R_s ($\Omega \cdot cm^2$)	R_{ct} ($\Omega \cdot cm^2$)	C_{dl} ($F \cdot cm^{-2}$)	*n*	θ	I_E (%)
25	0	0.65	175.6	1.50×10^{-4}	0.91	-	-
	0.01	0.48	557.1	1.27×10^{-4}	0.77	0.685	68.5
	0.05	0.36	679.3	1.09×10^{-4}	0.75	0.741	74.1
	0.1	0.43	714.6	7.80×10^{-5}	0.83	0.754	75.4
	0.5	0.33	976.8	6.25×10^{-5}	0.75	0.820	82.0
	1.0	0.40	1005	4.58×10^{-5}	0.80	0.825	82.5
50	0	0.15	15.86	4.18×10^{-4}	0.91	-	-
	0.01	0.25	47.21	3.61×10^{-4}	0.79	0.664	66.4
	0.05	0.21	57.22	2.67×10^{-4}	0.77	0.723	72.3
	0.1	0.14	61.26	2.35×10^{-4}	0.75	0.741	74.1
	0.5	0.27	74.68	1.85×10^{-4}	0.68	0.788	78.8
	1.0	0.22	88.11	1.23×10^{-4}	0.70	0.820	82.0
70	0	0.27	5.92	5.75×10^{-4}	0.91	-	-
	0.01	0.59	19.23	3.59×10^{-4}	0.71	0.692	69.2
	0.05	0.28	24.20	3.22×10^{-4}	0.72	0.755	75.5
	0.1	0.37	29.39	2.98×10^{-4}	0.74	0.799	79.9
	0.5	0.33	42.69	2.51×10^{-4}	0.69	0.861	86.1
	1.0	0.37	48.92	1.53×10^{-4}	0.74	0.879	87.9
90	0	0.43	1.06	1.54×10^{-3}	0.92	-	-
	0.01	0.34	3.80	1.46×10^{-3}	0.72	0.721	72.1
	0.05	0.39	5.73	6.77×10^{-4}	0.70	0.815	81.5
	0.1	0.50	11.04	3.39×10^{-4}	0.74	0.904	90.4
	0.5	0.39	16.32	2.90×10^{-4}	0.74	0.935	93.5
	1.0	0.48	18.59	2.21×10^{-4}	0.81	0.943	94.3

Table S3 Electrochemical data obtained from potentiodynamic polarization curves of mild steel in 1.0 M HCl with KI and 0.5 mM inhibitor at 90 ℃.

Condition	E_{corr} (mV)	i_{corr} (mA·cm^{-2})	b_c (mV·dec^{-1})	b_a (mV·dec^{-1})	C_R (mg·cm^{-2}·h^{-1})	θ	I_E (%)
0.5 mM inhibitor	-471	1.13	-76	87	11.8×10^{-1}	0.957	95.7
100 mM KI	-469	1.30	-73	74	13.6×10^{-1}	0.951	95.1
0.5 mM inhibitor +10 mM KI	-466	0.38	-106	123	4.0×10^{-1}	0.986	98.6
0.5 mM inhibitor +50 mM KI	-480	0.24	-102	130	2.5×10^{-1}	0.991	99.1
0.5 mM inhibitor +100 mM KI	-482	0.23	-94	128	2.4×10^{-1}	0.991	99.1

Table S4 Electrochemical data obtained from Nyquist plots of mild steel in 1.0 M HCl with KI and 0.5 mM inhibitor at 90 ℃.

Condition	R_s (Ω·cm^2)	R_{ct} (Ω·cm^2)	C_{dl} (F·cm^{-2})	n	θ	I_E (%)
0.5 mM inhibitor	0.39	16.32	2.90×10^{-4}	0.74	0.935	93.5
100 mM KI	0.37	14.87	2.93×10^{-4}	0.85	0.929	92.9
0.5 mM inhibitor +10 mM KI	0.26	65.62	4.75×10^{-4}	0.68	0.984	98.4
0.5 mM inhibitor +50 mM KI	0.39	78.61	1.61×10^{-4}	0.77	0.987	98.7
0.5 mM inhibitor +100 mM KI	0.39	85.20	5.82×10^{-5}	0.81	0.988	98.8

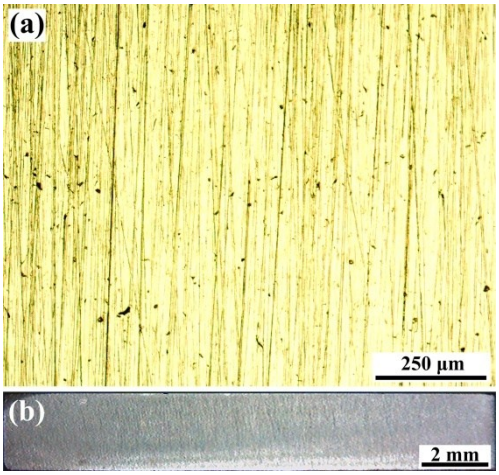

Fig. S2 Surface morphology of sample after weight loss experiment in 1.0 M HCl with 0.5 mM inhibitor and 50 mM KI at 90 ℃: (a) front surface and (b) bottom surface.