Supporting Information

Glutamic acid enhances the corrosion inhibition of polyaspartic acid on Q235 carbon steel

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Text S1. Pre-treatment of coupons

In the rotating hanging piece experiment of circulating cooling water, firstly, the specimens with a dimension of 50 × 25 × 2 mm^3 were wiped the rust grease with filter papers, then plates were scrubbed in acetone and absolute ethanol respectively, and finally dried with filter paper and put in the dryer for 4 h. Test pieces (10 × 10 × 2 mm^3) used in the electrochemical experiment were polished with 600 and 800 mesh sandpapers on the grinder. Then, the specimens were degreased with acetone in an ultrasonic cleaner, washed with absolute ethanol, and dried in the air prior to testing.

Text S2. SEM and AFM analysis

The coupons were first washed with the pickling solution (25% hydrochloric acid solution by volume), sodium hydroxide solution (60 g/L NaOH), and deionized water for 30 seconds in sequence, sucked their surface liquid, followed by dehydration using absolute ethanol for 3 minutes, sucked them dry with filter papers, and put in the dryer for more than 4 h. Finally, the coupons were dried in a supercritical CO_2 dryer. The surface morphology of coupons was obtained from 10 images that were randomly captured for each sample

Text S3. Molecular dynamics simulation

Q is the constant phase element (CPE) and given by:

$$Q_{CPE} = \frac{1}{Y_0(j\omega)^n} \qquad \text{eq(S1)}$$

Where Y_0, ω, and j are parameters related to the capacitive, angular frequency, and imaginary number, respectively. n is an exponential term related to the roughness of the electrolyte surface.

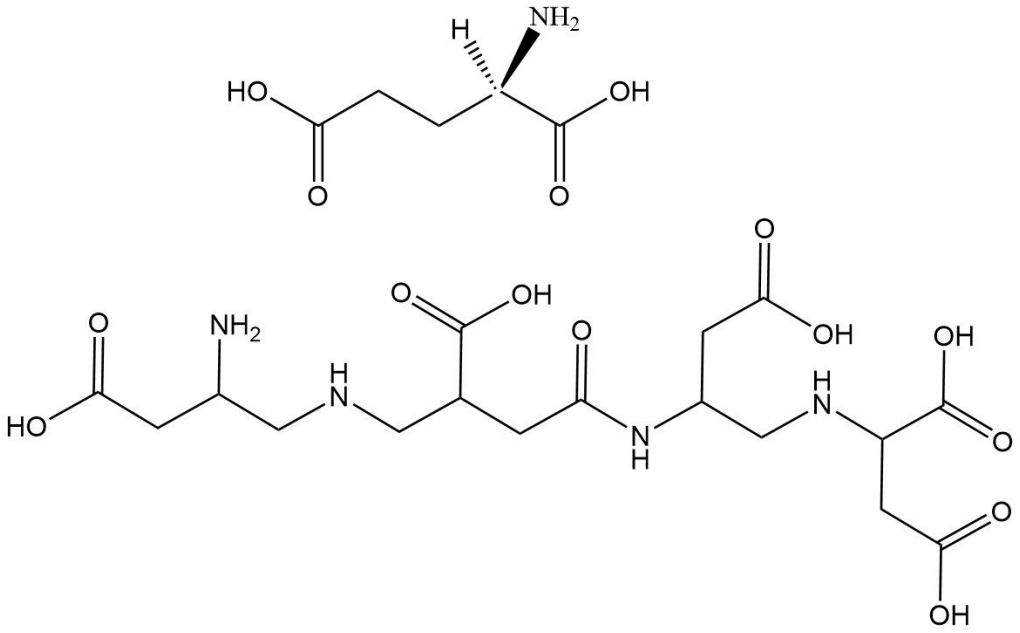

Figure S1. The two-dimensional structure of GLU and PASP.

Table S1 Fitting parameters of EIS for Q235 carbon steel in four systems at different time.

Group				Q_{dl}			Q_f		χ^2
	t (d)	R_s ($\Omega \cdot cm^2$)	R_{ct} ($\Omega \cdot cm^2$)	Y_0 ($10^{-4} \cdot S \cdot s^{n1} \cdot cm^{-2}$)	n1	R_f ($\Omega \cdot cm^2$)	Y_0 ($10^{-4} \cdot S \cdot s^{n2} \cdot cm^{-2}$)	n2	(10^{-4})
Blank	0	155.2	1847	6.83	0.69	613.9	5.51	0.97	3.1
	1	153.5	2384	7.10	0.63	36.0	7.40	0.65	2.6
	2	158.5	1249	9.59	0.60	1310.0	4.28	0.69	3.9
	3	158.2	2095	2.53	0.77	247.8	46.13	0.86	2.7
	4	185.0	2491	2.62	0.76	952.4	8.99	0.80	3.7
	5	165.1	1951	2.29	0.80	167.2	8.16	0.80	4.2
GLU	0	170.7	1483	3.02	0.69	72.4	9.61	0.65	5.2
	1	174.4	1110	4.87	0.77	1224.0	1.33	0.61	3.1
	2	173.0	4215	2.25	0.77	2575.0	6.35	0.77	3.4
	3	166.3	3091	2.50	0.76	413.3	3.90	0.76	2.7
	4	165.5	2834	2.56	0.77	182.6	2.26	0.83	5.8
	5	162.2	2757	1.73	0.91	39.8	0.78	0.91	6.3
PASP	0	240.4	3413	5.11	0.74	140.4	4.42	0.69	5.7
	1	242.6	3336	5.64	0.70	1283.0	2.98	0.73	3.2
	2	227.6	6502	1.39	0.81	632.2	1.87	0.92	4.1
	3	217.0	4570	1.51	0.80	182.1	53.15	0.93	3.7
	4	215.7	5202	1.12	0.76	302.5	1.51	0.76	5.5
	5	226.3	3388	1.96	0.76	597.8	17.97	0.82	5.9
PASP +GLU	0	260.8	1719	7.21	0.64	1457.0	3.68	0.62	4.1
	1	250.3	5914	1.43	0.81	659.6	3.07	0.93	3.4
	2	237.3	11540	1.35	0.78	2530.0	1.45	0.90	2.1
	3	225.7	10870	0.13	0.87	330.2	1.21	0.75	9.2
	4	226.9	5812	5.29	0.93	248.4	1.42	0.79	5.4
	5	239.9	4156	0.17	0.91	246.2	1.31	0.76	4.1

Table S2 Electrochemical parameters of potentiodynamic polarization curve of Q235 steel in different groups

Group	Time (d)	Car SIp (1/V)	Ano Sip (1/V)	I_{corr} (10^{-6} A)	CR(mil/year)	P_{corr} (%)
Blank	0	7.24	5.29	9.391	4.31	
	1	10.13	2.77	34.34	11.17	
	2	6.56	4.19	14.64	6.72	
	3	5.85	4.52	14.49	6.65	
	4	6.06	3.81	16.24	7.46	
	5	5.90	3.99	16.14	7.41	
GLU	0	11.61	2.88	16.91	7.76	-80.07
	1	10.05	3.33	20.62	9.47	39.95
	2	6.41	4.17	14.91	6.84	-1.84
	3	6.84	5.67	11.15	5.12	23.05
	4	5.88	4.53	15.93	7.31	1.91
	5	5.87	4.46	15.43	7.08	4.40
PASP	0	6.17	5.30	7.05	3.24	24.93
	1	9.83	3.98	8.096	3.72	76.42
	2	10.26	5.10	6.467	2.97	55.83
	3	9.68	3.93	9.147	4.20	46.16
	4	9.62	4.26	9.401	4.32	42.11
	5	6.39	3.84	18.04	8.28	-11.77
PASP+GLU	0	5.76	6.46	7.261	3.33	22.68
	1	9.38	3.78	8.656	3.97	74.79
	2	10.68	6.48	4.599	2.11	68.59
	3	9.60	4.72	6.353	2.92	62.61
	4	5.76	4.96	9.067	4.16	44.17
	5	5.56	2.71	12.82	5.88	20.57