Supporting Information

for RSC Advances

Deciphering the formation mechanism of protective corrosion product layer from electrochemical and natural corrosion behaviors of nanocrystalline zinc coating

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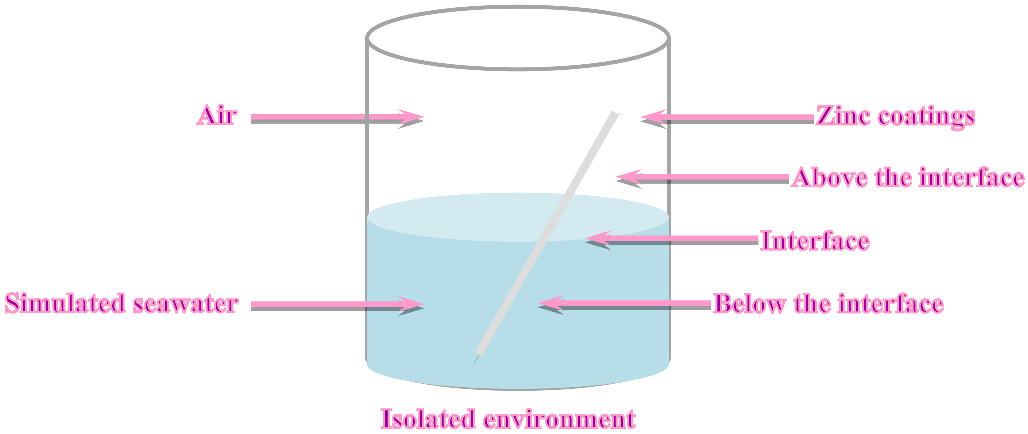

Fig. S1 Schematic diagram for natural corrosion behaviors of coarse-grained and nanocrystalline zinc coatings.

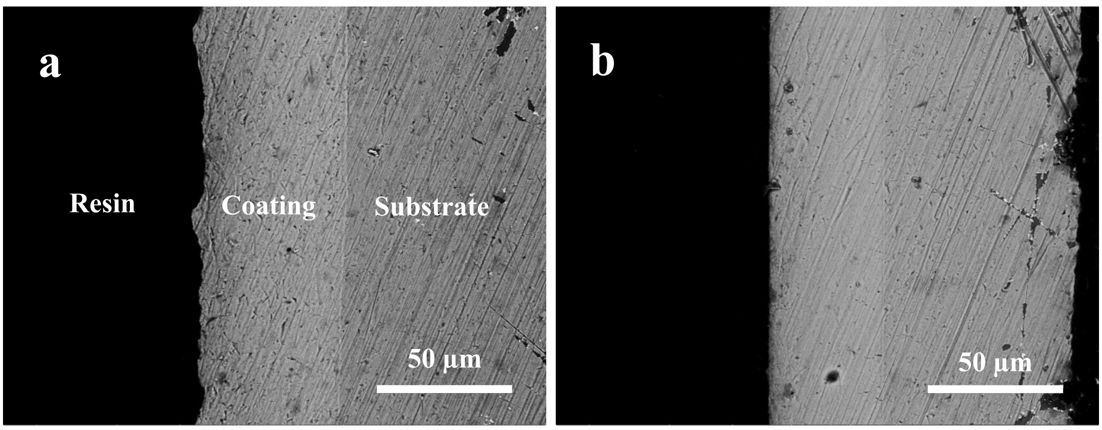

Fig. S2 Cross-sectional morphologies of the coarse-grained (a) and nanocrystalline (b) zinc coatings.

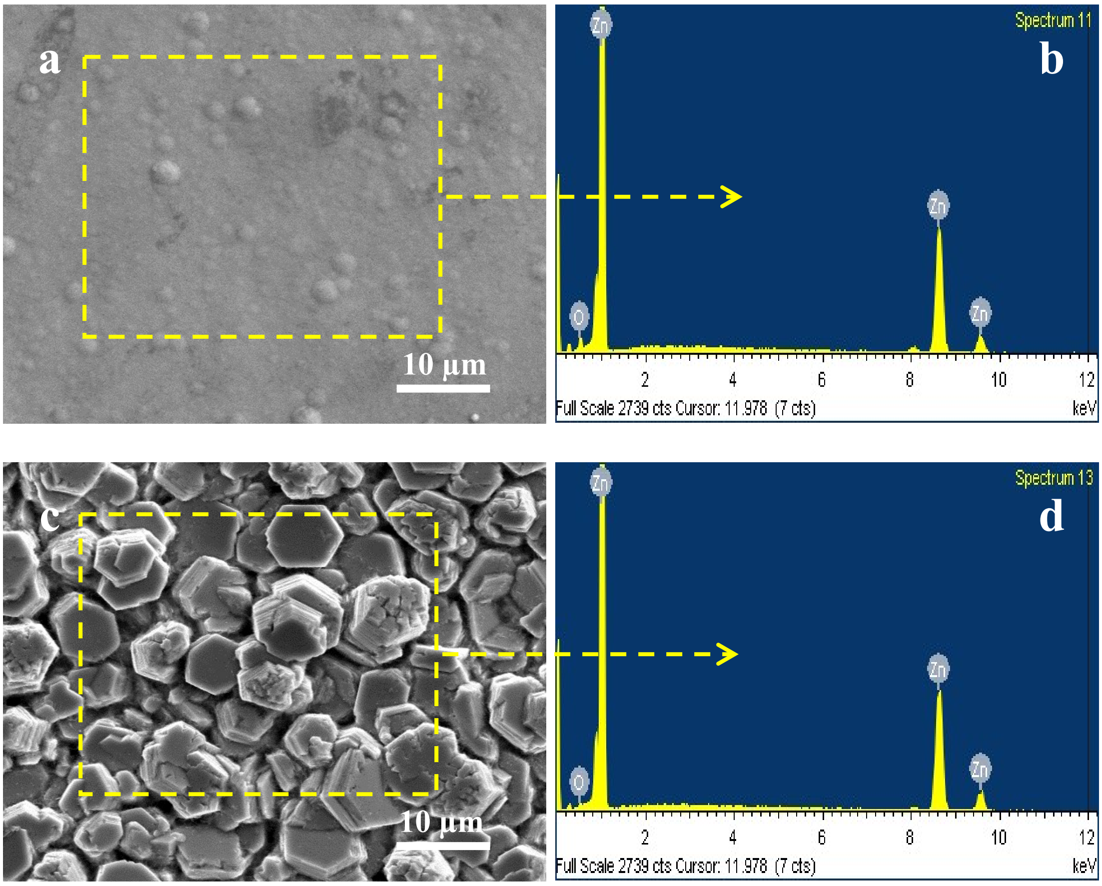

Fig. S3 FESEM images and corresponding EDS patterns for the coarse-grained (a, b) and nanocrystalline (c, d) zinc coatings after 100 h of placement in an isolate environment without any corrosive medium as similar to Fig. S1.

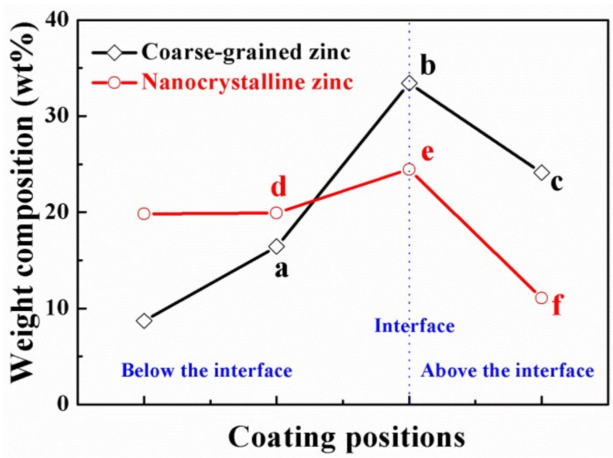

Fig. S4 Atomic oxygen contents of the corroded surfaces of coarse-grained and nanocrystalline zinc coatings in simulated seawater after 100 h of immersion. (Points a-f corresponding to the O contents of EDS spectrums in Fig. 10, respectively.)

Table S1 Fitting results for the EIS data acquired from coarse-grained (CG) and nanocrystalline (NC) zinc coatings in simulated seawater.

Sample	R_s	Q_l	n	R_l	Q_{dl}	n	R_{ct}	Z_w	Chi squired
	Ω cm^2	F cm^{-2}	0<n<1	Ω cm^2	F cm^{-2}	0<n<1	Ω cm^2	Ω cm^2 sec$^{-0.5}$	
CG	19.65	1.515×10^{-4}	0.8159	132.2	8.215×10^{-3}	0.6486	121.9	0.1082	3.374×10^{-4}
Error %	0.5233	4.216	0.7789	2.107	4.943	5.468	6.312	10	
NC	11.22	1.323×10^{-4}	0.5103	6.162	8.67×10^{-6}	0.9514	360.2	0.04448	1.607×10^{-4}
Error %	1.831	4.389	1.51	4.746	10	0.1325	0.5268	3.781	

Table S2 Fitting results for the EIS data acquired from the corrosion product layer of coarse-grained (CG-P) zinc coating in simulated seawater.

Sample	R_s	C_{l1}	R_{l1}	C_{l2}	R_{l2}	C_{dl}	R_{ct}	Chi squired
	Ω cm^2	F cm^{-2}	Ω cm^2	F cm^{-2}	Ω cm^2	F cm^{-2}	Ω cm^2	
CG-P	16.73	2.818×10^{-5}	18.59	9.481×10^{-5}	31.64	5.313×10^{-3}	47.14	1.28×10^{-3}
Error %	0.9606	4.709	5.762	7.573	3.634	5.102	2.786	

Table S3 Fitting results for the EIS data acquired from the corrosion product layer of nanocrystalline (NC-P) zinc coating in simulated seawater.

Sample	R_s	C_l	R_l	C_{dl}	R_{ct}	Z_w	Chi squired
	Ω cm^2	F cm^{-2}	Ω cm^2	F cm^{-2}	Ω cm^2	Ω cm^2 sec$^{-0.5}$	
NC-P	17.86	1.727×10^{-5}	52.18	2.202×10^{-5}	86.89	0.0441	5.470×10^{-4}
Error %	0.6351	2.042	6.131	6.296	3.714	6.976	