Electronic Supplementary Information

Fabrication and properties of superhydrophobic film on electroless plated magnesium alloy

Jing Yuan[a,b] , Jihui Wang[a, c]*, Kaili Zhang[c], Wenbin Hu[c]

a. State Key Laboratory of Hydraulic Engineering Simulation and Safety, Tianjin University, Tianjin 300072, P R China

b. College of Physics Electronic Information Engineering, Qinghai University for Nationalities, Xining, Qinghai 810007, P R China

c. Tianjin Key Laboratory of Composite and Functional Materials, School of Materials Science and Engineering, Tianjin University, Tianjin 300072, P R China

* Corresponding author
Email address: jhwang@tju.edu.cn

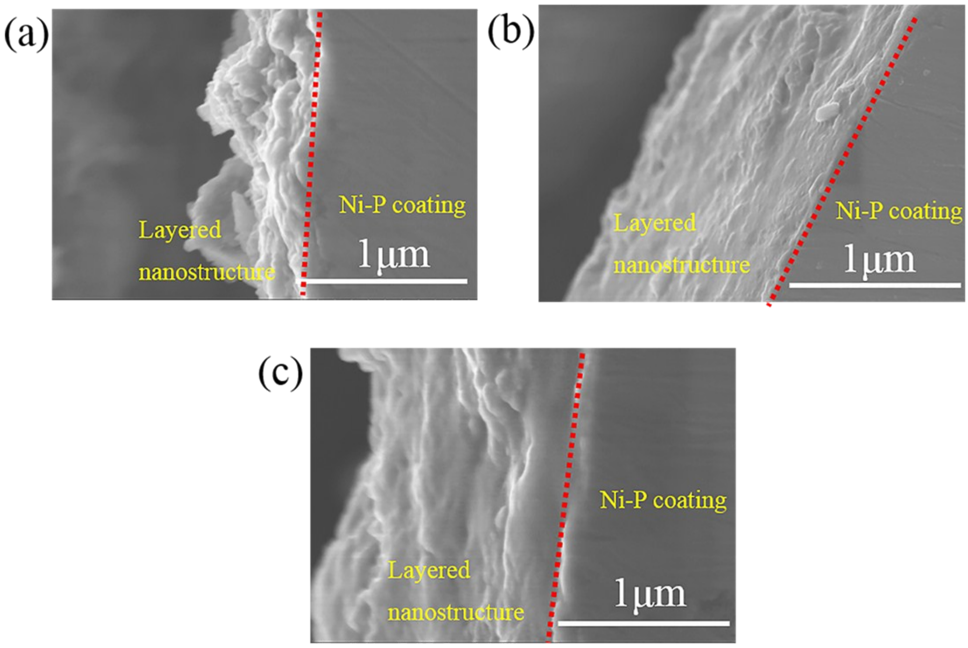

Fig. S1 Cross-section morphologies of sample after hydrothermal reaction for 15h under different reaction temperatures: (a) 120℃, (b) 140℃ and (c) 160℃.

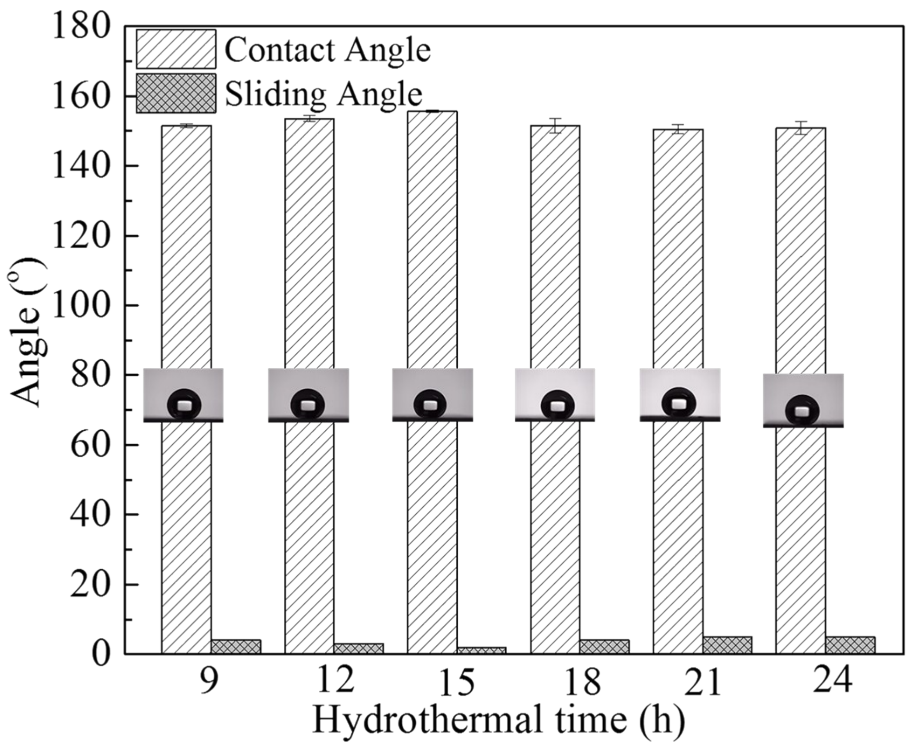

Fig. S2. Variation of water contact angle and sliding angle of superhydrophobic film with hydrothermal reaction time.

The XRD pattern of S1 (AZ61 magnesium alloy), the diffraction peaks at 32.2°, 34.4°, 36.6°, 47.8°, 57.4°, 63.1° and 68.7° were attributed to (100), (002), (101), (102), (110), (103) and (112) planes of α-Mg phase, but peaks at 36.2° and 40.2° corresponded to (321) and (400) planes of β-$Mg_{17}Al_{12}$ phase.

The FT-IR spectra of S3 ($Ni_3(NO_3)_2(OH)_4$) reveals the existence of -OH stretching vibration (~3600 cm^{-1}), C-H bending vibration (~1380 cm^{-1}), -OH bending vibration (~647 cm^{-1}), -NO_3 bending vibrations (~996 cm^{-1}, ~1316 cm^{-1}), Ni-O vibration and Ni-O-H bending vibration (~480 cm^{-1}). In addition, the peaks observed at 1497 cm^{-1} is assigned to the various vibrational modes of the carbonate groups originating from the adsorption of atmospheric CO_2.[1]

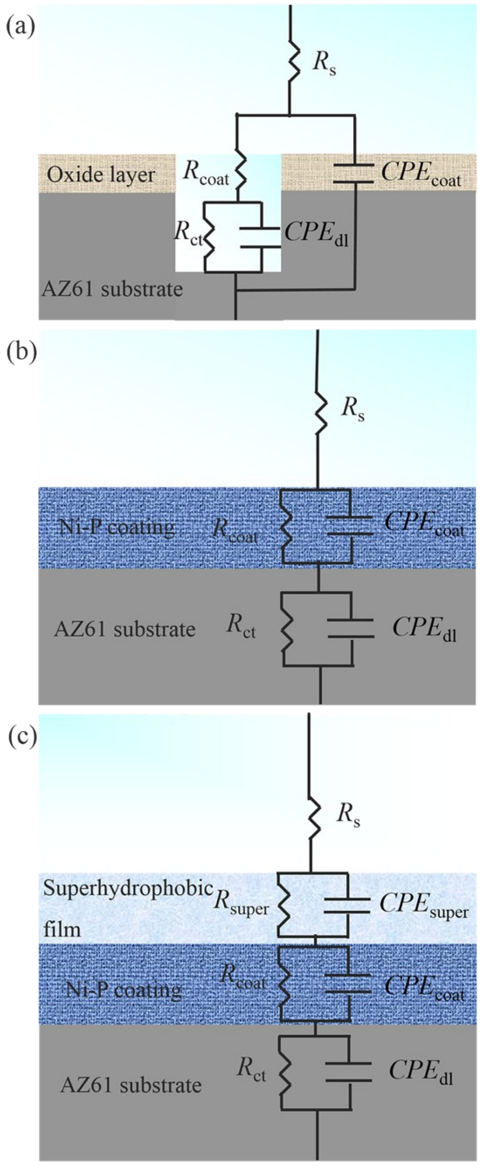

Fig. S3 Equivalent circuit for EIS spectra of (a) AZ61 substrate, (b) Ni-P coating and (c) superhydrophobic surface.

The origin of various components of the equivalent circuit. R_s: electrolyte solution; CPE_{coat} and R_{coat}: Ni-P coating (oxide layer for AZ61 substrate); CPE_{super} and R_{super}: superhydrophobic film; CPE_{dl} and R_{ct}: double electric layer of AZ61 substrate.

Table S1 EIS fitting parameters of AZ61substrate, Ni-P coating and superhydrophobic film in 3.5%NaCl solution.

	R_s (Ω*cm²)	Q_{super}-Y_0 (A/cm²)	n_{air}	R_{super} (Ω*cm²)	Q_{coat}-Y_0 (A/cm²)	n_{coat}	R_{coat} (Ω*cm²)	Q_{dl}-Y_0 (A/cm²)	n_{dl}	R_{ct} (Ω*cm²)
AZ61 substrate	13.3	--	--	--	1.5×10^{5}	0.9	5.6×10^{2}	10.3	0.9	1.6×10^{3}
Ni-P coating	10.2	--	--	--	2.4×10^{2}	0.8	6.1×10^{3}	31.9	0.9	3.4×10^{3}
Superhydrophobic flim	1.0	6.3×10^{-7}	0.7	5.8×10^{5}	4.6×10^{-7}	0.7	5.0×10^{4}	2.5×10^{-6}	0.7	1.1×10^{7}

1. H.F. Zhang, M. Liu, H.S. Fan and X.D. Zhang, *Mater. Lett.*, 2012, 75, 26-28.