Supporting Information

For RSC Advances

Studies on the enhanced properties of nanocrystalline Zn-Ni coatings from a new alkaline bath due to the additives

Zhongbao Feng, Qingyang Li, Jinqiu Zhang, Peixia Yang, Maozhong An*

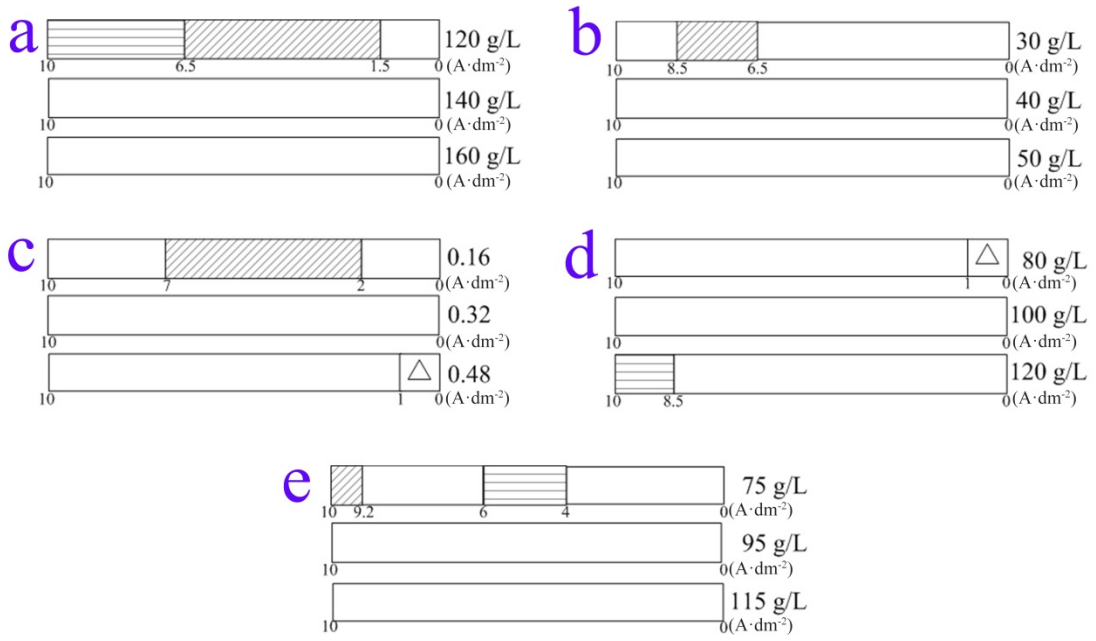


Fig. S1 Effect of the bath composition on the brightness range of Zn-Ni alloy deposits: a) DMH content, b) $Na_4P_2O_7 \cdot 10H_2O$ content, c) $Ni^{2+}/(Zn^{2+}+Ni^{2+})$ ratio, d) $(Zn^{2+}+Ni^{2+})$ content, e) K_2CO_3 content, (▵ means that no Zn-Ni alloy coatings exists in the substrate surface, ▭ means that the surface of Zn-Ni alloys is semi bright, ▨ means that the surface of Zn-Ni alloys is grey, □ means that the surface of Zn-Ni alloys is mirror bright).

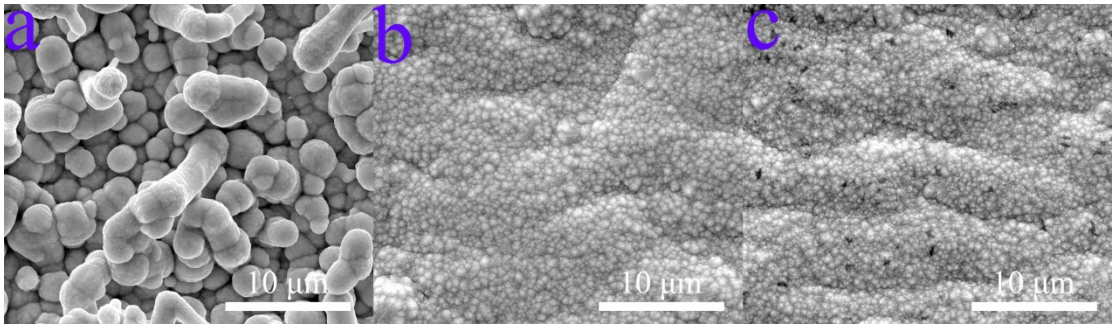


Fig. S2 Effect of DMH content on the surface morphologies of Zn-Ni alloy deposits: a) 120 g/L, b) 140 g/L, c) 160 g/L.

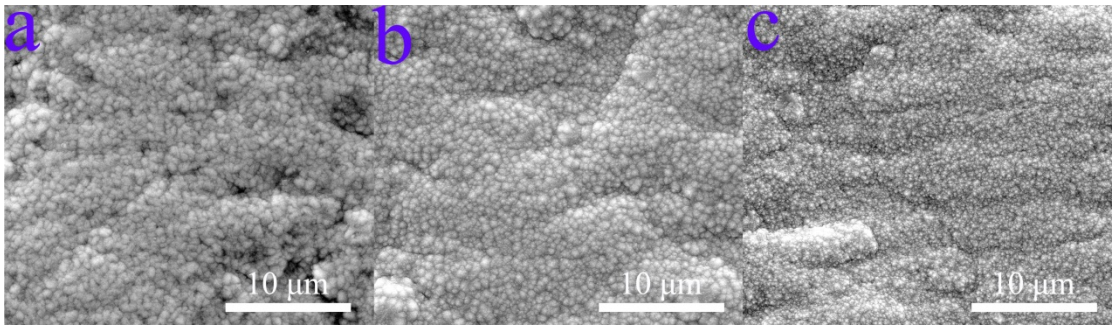


Fig. S3 Effect of $Na_4P_2O_7 \cdot 10H_2O$ DMH content on the surface morphologies of Zn-Ni alloy deposits: a) 30 g/L, b) 40 g/L, c) 50 g/L.

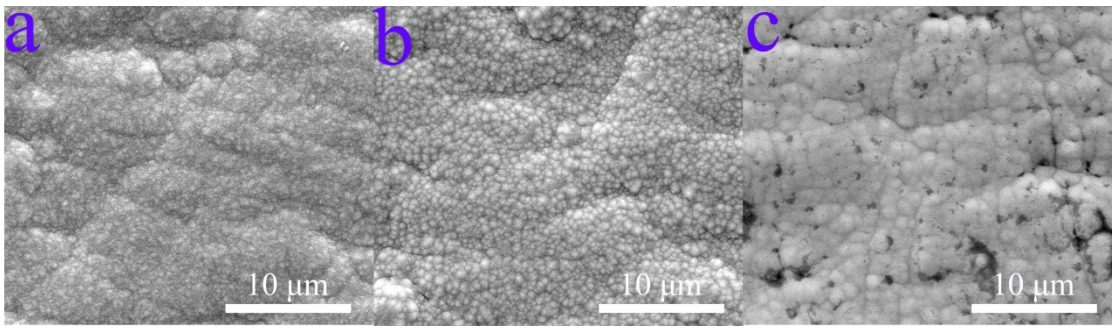


Fig. S4 Effect of $Ni^{2+}/(Zn^{2+}+Ni^{2+})$ ratio on the surface morphologies of Zn-Ni alloy deposits: a) 0.16, b) 0.32, c) 0.48.

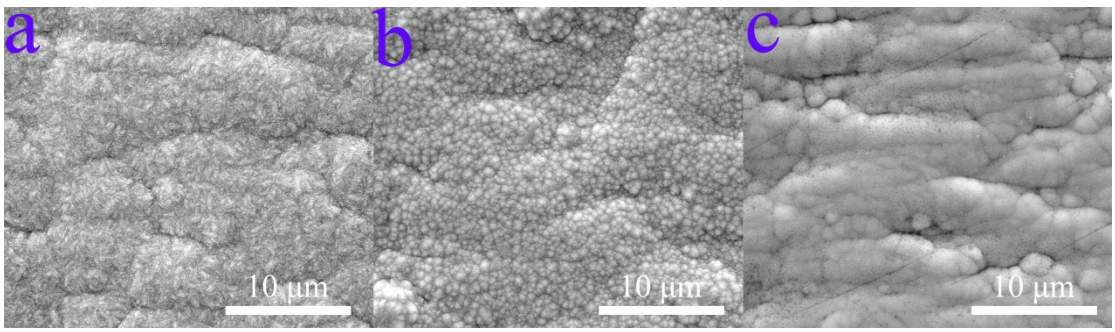


Fig. S5 Effect of (Zn^{2+}+Ni^{2+}) content on the surface morphologies of Zn-Ni alloy deposits: a) 80 g/L, b) 100 g/L, c) 120 g/L.

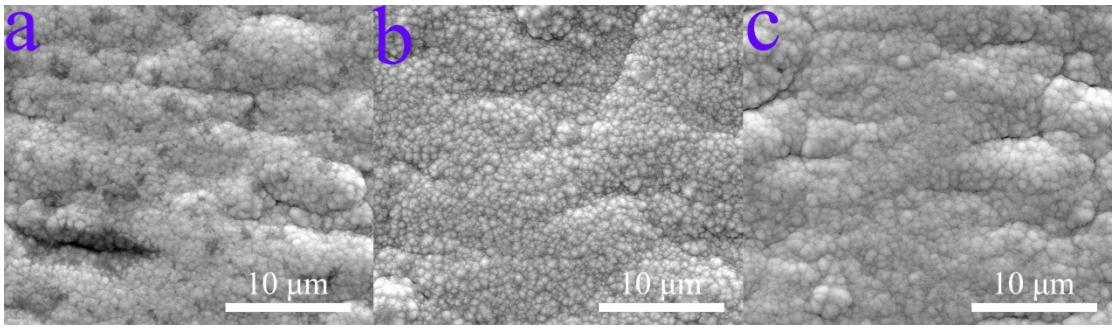


Fig. S6 Effect of K_2CO_3 content on the surface morphologies of Zn-Ni alloy deposits: a) 75 g/L, b) 95 g/L, c) 115 g/L.

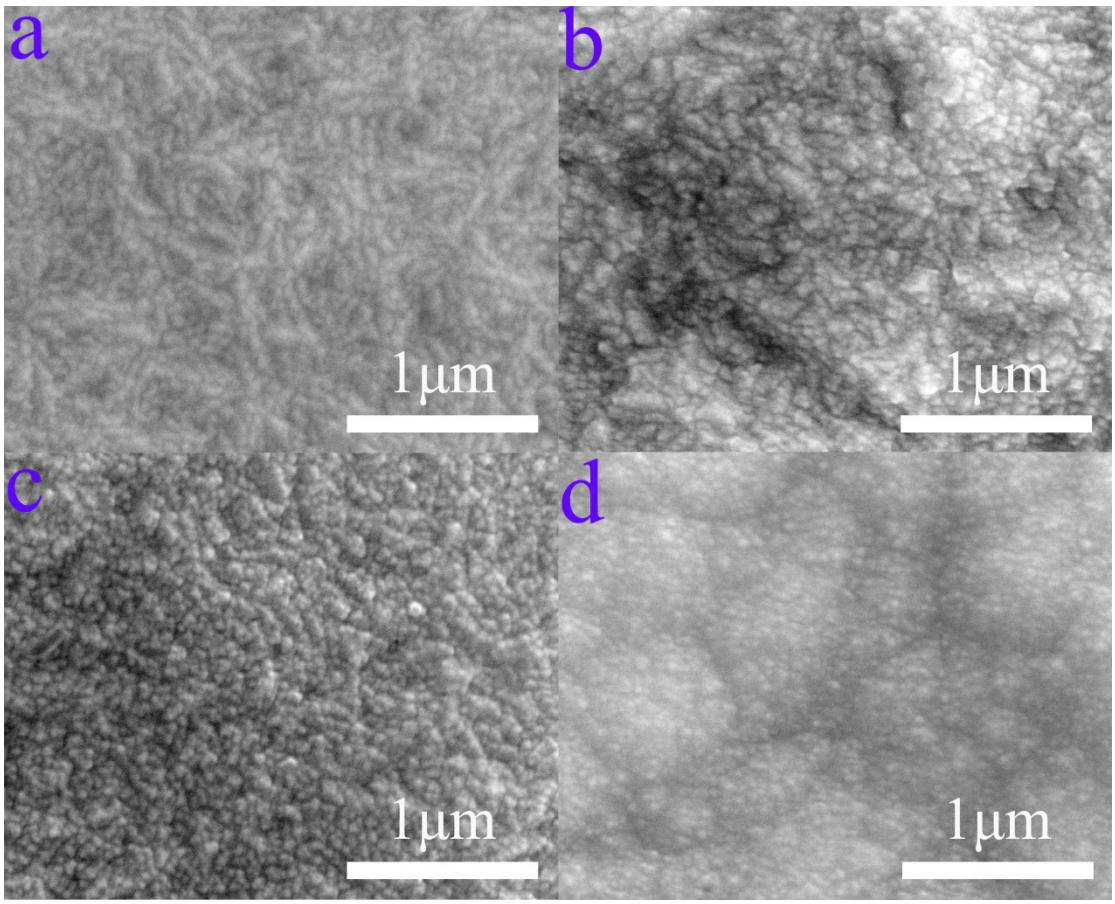


Fig. S7 SEM images of Zn-Ni alloys deposited from different baths: a) basic bath with 0 mg/L CA and 15 mg/L VL, b) basic bath with 10 mg/L CA and 15 mg/L VL, c) basic bath with 15 mg/L CA and 15 mg/L VL, d) basic bath with 20 mg/L CA and 15 mg/L VL.

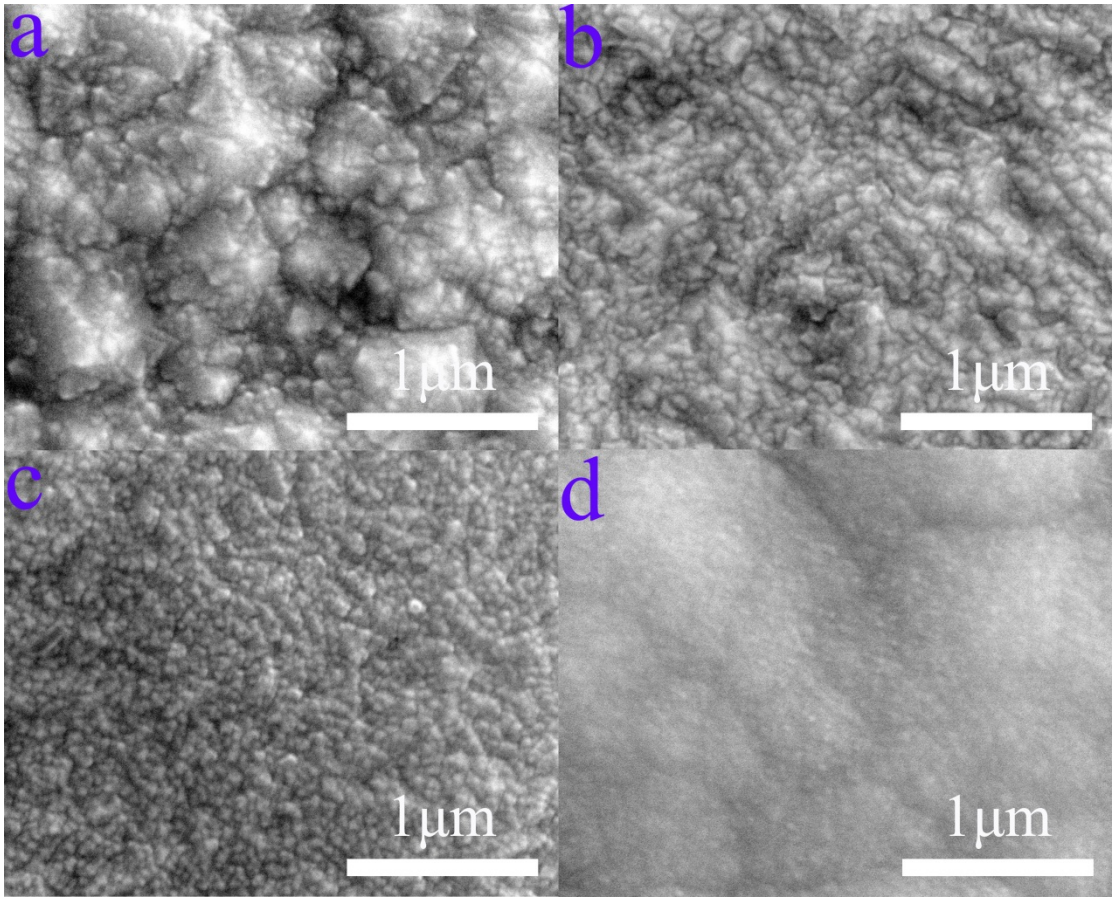


Fig. S8 SEM images of Zn-Ni alloys deposited from different baths: a) basic bath with 0 mg/L VL and 15 mg/L CA, b) basic bath with 10 mg/L VL and 15 mg/L CA, c) basic bath with 15 mg/L VL and 15 mg/L CA, d) basic bath with 20 mg/L VL and 15 mg/L CA.

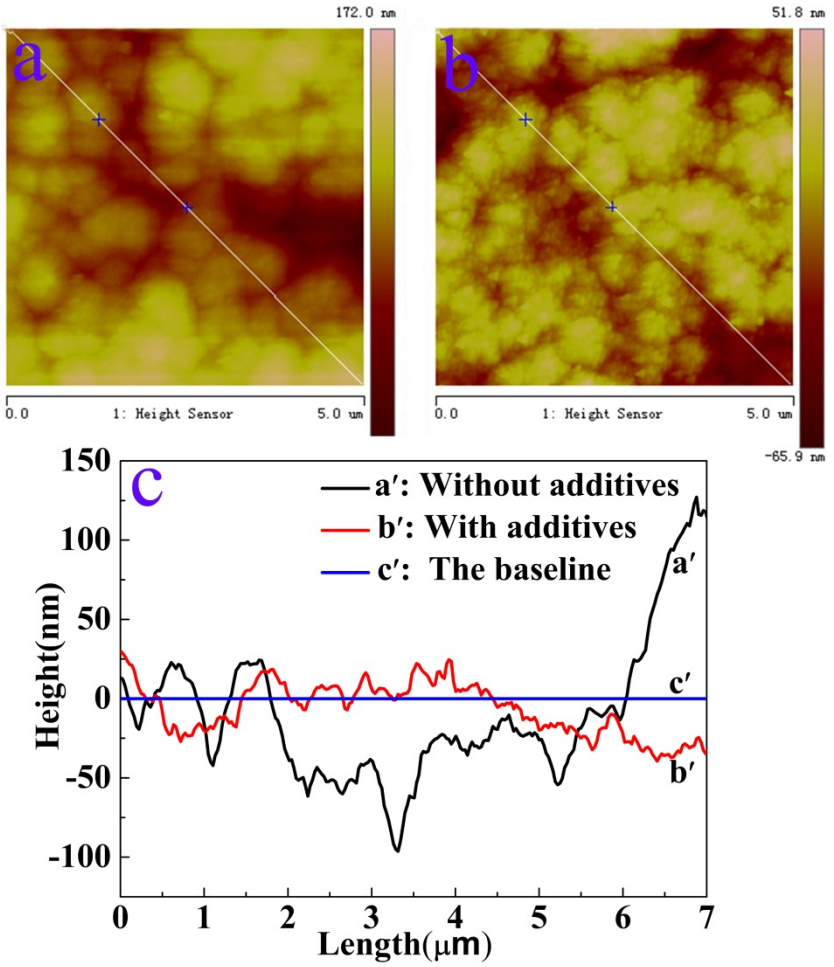


Fig. S9 a) AFM topographic images of Zn-Ni alloy deposits obtained from the baths without additives, b) AFM topographic images of Zn-Ni alloy deposits obtained from the baths with additives and c) section analysis of Zn-Ni alloys obtained from the baths with and without additives.

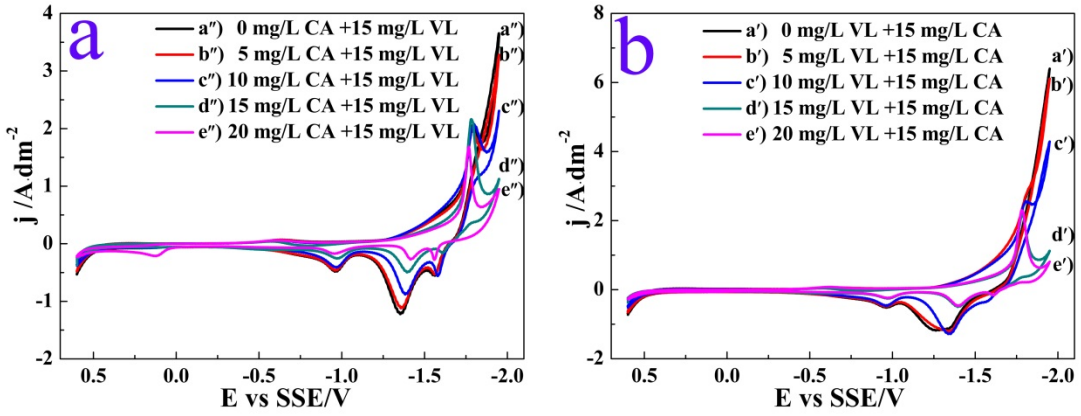
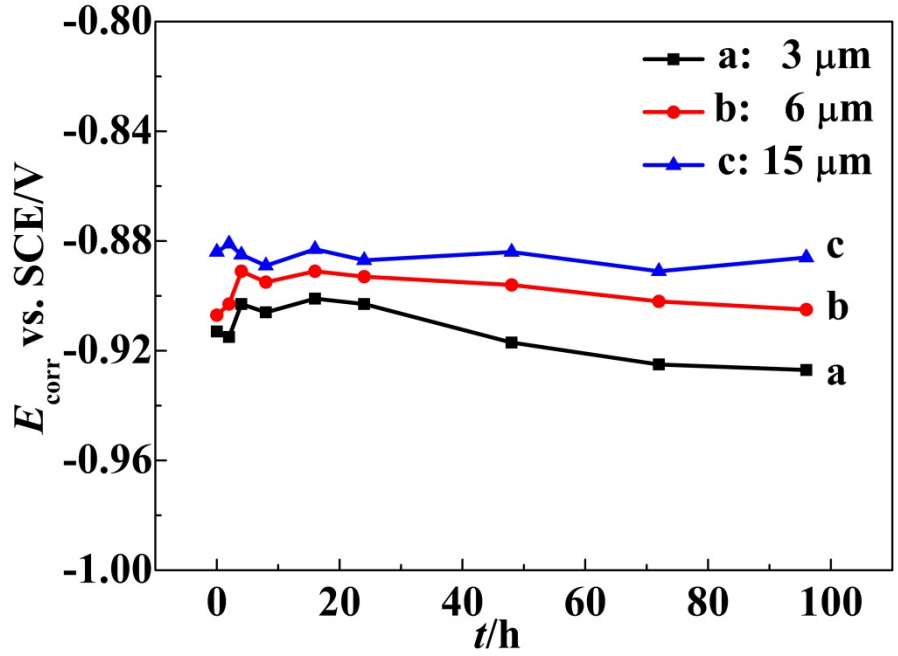


Fig. S10 CV curves of Zn-Ni alloys on Pt electrode obtained from the bath with: a) different concentrations of CA and15 mg/L VL, b) different concentrations of VL

48 and15 mg/L CA.



49

50 Fig. S11 The corrosion potential vs. time behaviors of steel substrate samples coated
51 with different thickness of Zn-Ni alloy deposits immersed in 3.5% NaCl at 25 °C over
52 96 h: a) 3 μm, b) 6 μm, c) 15 μm.