Supporting information:

Synthesis of NiCoFe LDH nanoparticles: The NiCoFe LDH nanoparticles (NPs) were prepared by coprecipitation and subsequent hydrothermal treatment, in which the salt and alkali solutions were quickly mixed and nucleated in a colloid mill. Typically, 10 mL of mixed salt solution containing $Co(NO_3)_2{\cdot}6H_2O$ (1.0 mmol), $Fe(NO_3)_3{\cdot}9H_2O$ (1.0 mmol) and $Ni(NO_3)_2{\cdot}6H_2O$ (1.0 mmol) and 30 mL of NaOH (6.0 mmol) and Na_2CO_3 (0.53 mmol) solution were simultaneously poured out into a colloidal mill with vigorous stirring for 10 min. The resulting slurry was centrifuged at 12,000 rpm for 15 min and washed twice with deionized water to remove the excess free metal salts and alkali, and subsequently dispersed in 35 mL of deionized water. This aqueous suspension was transferred into a stainless steel autoclave with a Teflon lining. The autoclave was then placed in a preheated oven, followed by hydrothermal treatment at 100 °C for 2 h.

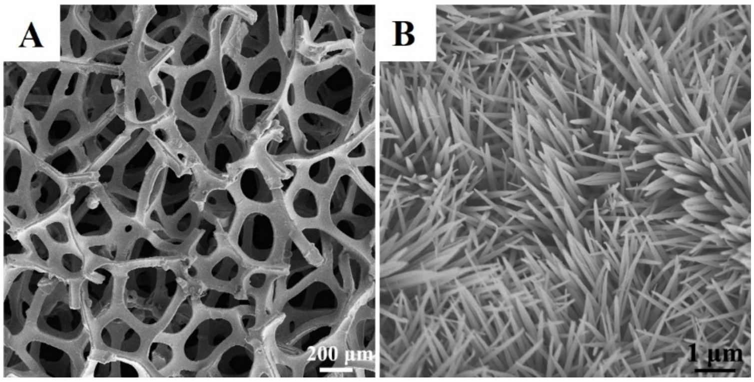

Figure S1 SEM images of the (A) pure Ni foam and (B) $Co_2(OH)_2CO_3$ NWAs.

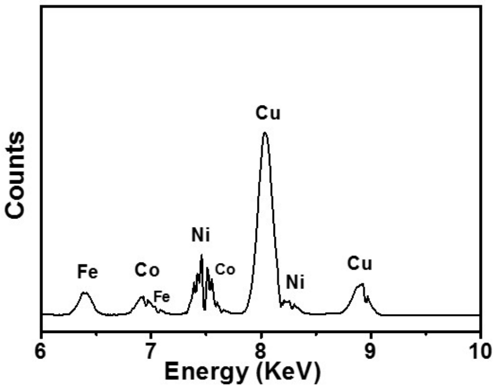

Figure S2 EDS analysis of the NiCoFe LDH nanoplate (The Cu element was from the copper grid).

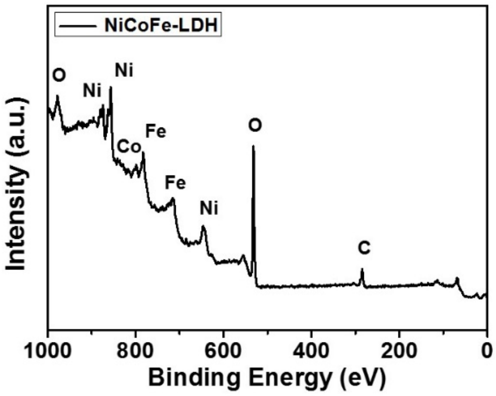

Figure S3 XPS spectrum of the H-LDH nanoarrays.

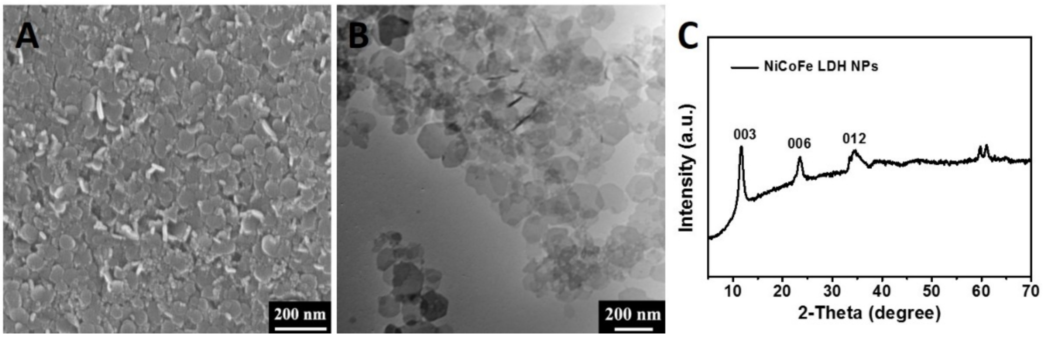

Figure S4 (A) SEM image, (B) TEM image, and (C) XRD pattern of the as-prepared NiCoFe LDH NPs.

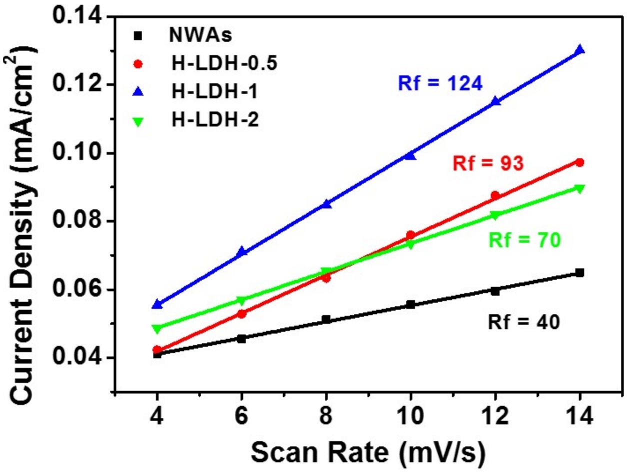

Figure S5 Plots of the current density at 1.08 V vs the scan rate to determine the roughness factor.

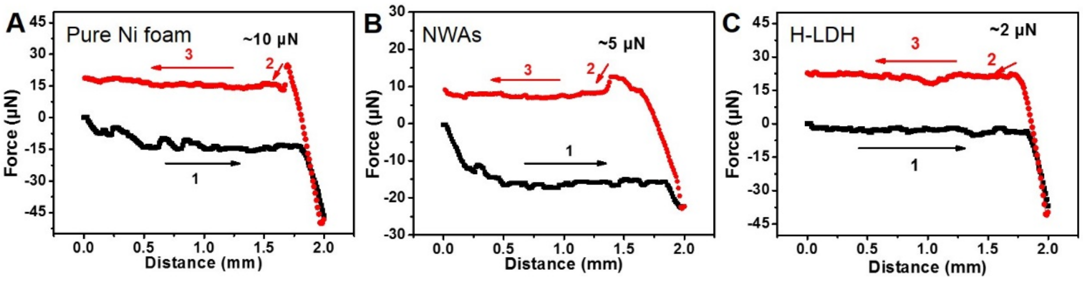

Figure S6 Adhesive forces measurements of the gas bubbles on the (A) pure Ni foam; (B) NWAs; and (C) H-LDH. *Process 1*: electrode surfaces contact with the gas bubble; *Process 2*: electrode surfaces left the gas bubble after contact; *Process 3:* electrode surfaces broke away from the gas bubble.