**Electronic Supporting Informations**

**Direct growth of NiCo$_2$S$_x$ nanostructures on stainless steel with enhanced electrocatalytic activity for methanol oxidation**

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Experimental section

*Direct growth of NiCo$_2$S$_x$ nanostructures on SS substrate*

Before electrodeposition, SS substrates were cleaned in an ultrasonic bath in dilute HNO$_3$, acetone and water sequently. During the electrodeposition process, SS was used as working electrode, Pt wire and saturated calomel electrode (SCE) were used as counter and reference electrode. Co-Ni double hydroxide (Co-Ni LDHs) were electrodeposited on SS substrate in a aqueous electrolyte with 0.02 M Co(NO$_3$)$_2$ and 0.01 M Ni(NO$_3$)$_2$ at a deposition potential of -1.0 V and deposition time of 30 min. After cleaned with water, the Co-Ni LDHs/SS were inserted into a 0.2 M Na$_2$S solution. Finally, after Vulcanized overnight, the Co-Ni LDHs were fully converted into NiCo$_2$S$_x$. The NiCo$_2$S$_x$ on ITO substrate were synthesized by the same method using ITO as substrate. The NiCo$_2$S$_x$ on ITO were used for cross-sectional SEM characterization because the ITO is fragile, in the process of obtaining the cross section, the morphology of the Ni-Co LDHs can be fully preserved. The NiS$_x$ or the CoS$_x$ were synthesized by the same method using Ni(NO$_3$)$_2$ or Co(NO$_3$)$_2$ as Ni source or Co source.
Fig. S1 XRD pattern of NiCo$_2$S$_x$ after vulcanization before calcination.

Fig. S2 XRD patterns of NiS$_x$ and CoS$_x$.

Fig. S3 XRF pattern of NiS$_x$. 
The methanol oxidation performance on Co-Ni LDHs/SS and blank SS were investigated by CV and chronoamperometry methods. The results were shown in Fig S5, S6 and S7.

Fig. S5 CV curves of Co-Ni LDHs/SS electrode in 1 M KOH electrolyte without (black) and with (red) 0.5 M methanol at a scan rate of 10 mV s⁻¹.

Fig. S4 XRF pattern of CoSₓ.
Fig. S6 CV curves of blank SS electrode in 1 M KOH electrolyte without (black) and with (red) 0.5 M methanol at a scan rate of 10 mV s^{-1}.

Fig. S7. Chronoamperometry curves of Co-Ni LDHs/SS (black) and blank SS (red) electrode in 1 M KOH electrolyte with 0.5 M methanol at 0 V (0-100 s) and 0.6 V (101-1100 s).