Supporting Information

Selective integration of hierarchical nanostructured energy materials: An effective approach to boost energy storage performance of flexible hybrid supercapacitor

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Experimental Section

Preparation of NiO@NiO-$NiCo_2O_4$ NSAs on Cu-Ni fabric:

Typically, 0.1 M $NiSO_4.6H_2O$ and 0.2 M $C_6H_{12}N_4$ were dissolved in 80 mL DI water by constant stirring. The above solution with NiO-$NiCo_2O_4$ loaded fabrics were transferred to autoclave and maintained at 100 ^oC for 2 h. After, the NiO@NiO-$NiCo_2O_4$ NSAs material loaded electrodes were washed and dried at 80 ^oC for 12 h.

Preparation of Co_3O_4@NiO-$NiCo_2O_4$ NSAs on Cu-Ni fabric:

0.1 M $CoCl_2.6H_2O$ and 0.2 M CH_4N_2O were dissolved in a 80 mL of DI water by constant stirring. The above solution with NiO-$NiCo_2O_4$ loaded fabrics were transferred to autoclave and maintained at 100 ^oC for 2 h. After cooling down to room temperature, the Co_3O_4@NiO-$NiCo_2O_4$ NSAs material loaded electrodes were washed and dried at 80 ^oC for 12 h.

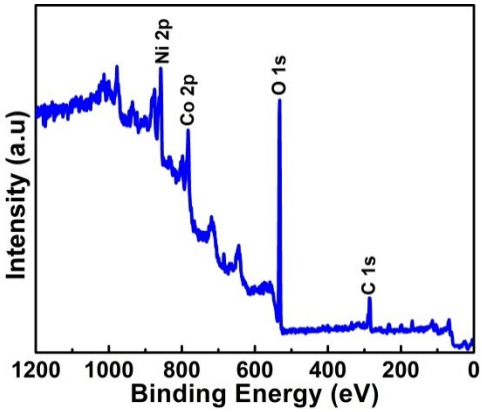

Figure S1. XPS survey spectrum of $Ni(OH)_2$@NiO-$NiCo_2O_4$

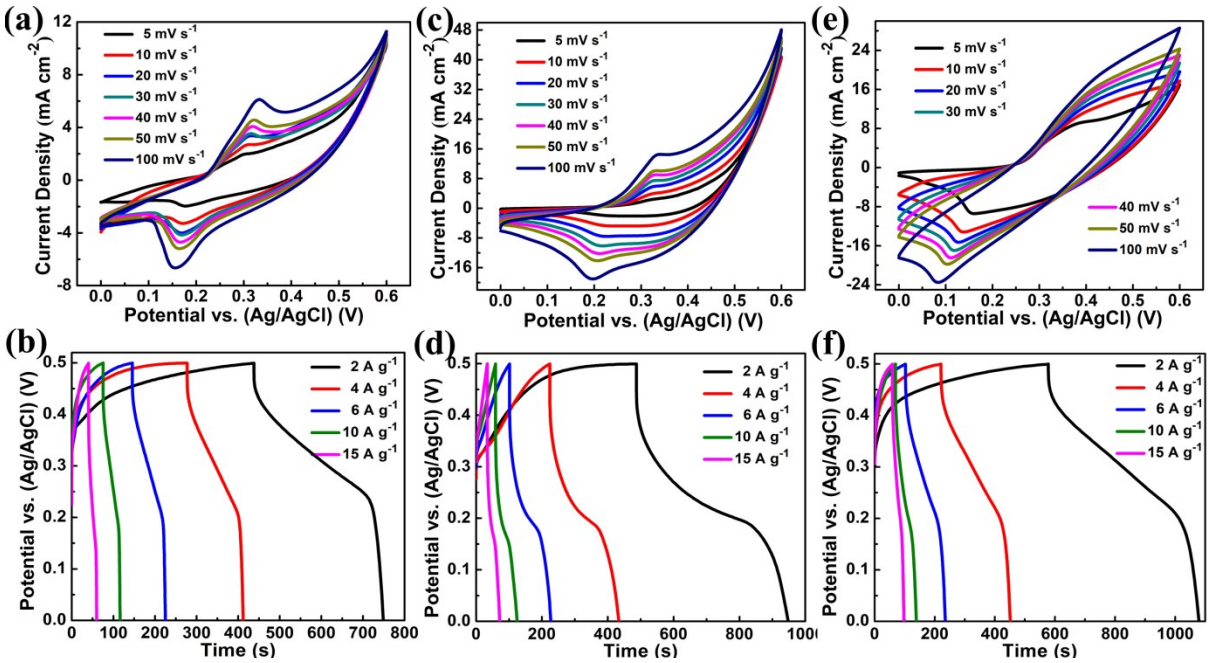

Figure S2. (a,c,e) CV and (b,d,f) GCD curves of (a,b) NiO-$NiCo_2O_4$ NSAs (c,d) NiO@NiO-$NiCo_2O_4$ NSAs and (e,f) CO_3O_4@NiO-$NiCo_2O_4$ NSAs fabric electrodes in 3 M KOH electrolyte solution

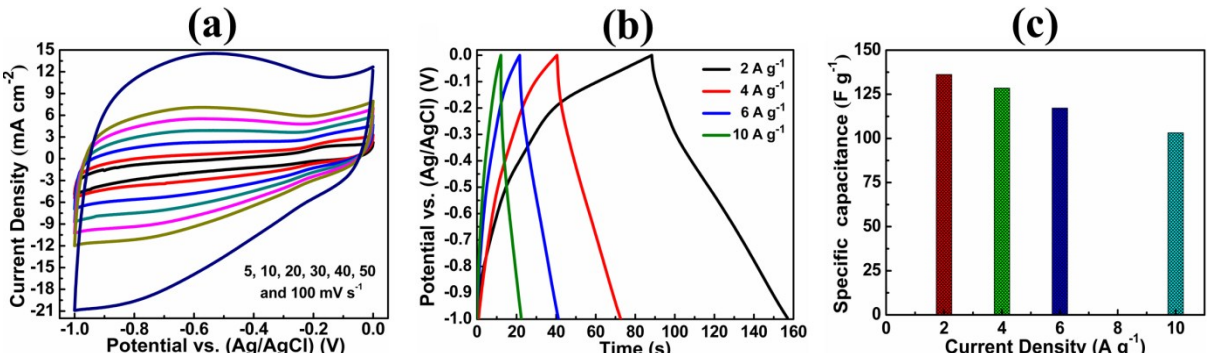

Figure S3. (a) CV and (b) GCD curves investigated at various scan rates and current densities, respectively. (c) Specific capacitance of the graphene-ink (G-ink)@Cu-Ni fabric electrode at different current densities.

Graphene-ink (G-ink) was received from MExplorer Co., Ltd. and it shows nanosheets morphology.[S1] The mass of the G-ink on Cu-Ni fabric was obtained to be ~ 3.2 mg cm^{-2}. The electrochemical properties of negative electrode were characterized in a three-electrode system by taking G-ink@Cu-Ni fabric, Ag/AgCl and Pt-wire as working, reference and counter electrodes, respectively, in 3 M KOH aqueous electrolyte. Fig. S3(a) shows the cyclic voltammetry curves (CVs) of G-ink@Cu-Ni fabric electrode measured at different scan rates ranging from 5-100 mV s^{-1} in the potential window of -1.0 to 0.0 V. All the CV plots exhibited symmetrical rectangular shapes, representing the typical EDLC behavior of negative electrode. Moreover, it is clear that all the CV curves maintained their shapes even at higher sweep rates, specifying the rapid charge transfer process between the electrolyte and G-ink electrode. The galvanic charge-discharge (GCD) of G-ink was measured at different current densities from 2 to 10 A g^{-1} in the voltage window of -1.0 to 0.0 V, as shown in Fig. S3(b). The linear and symmetric shapes of GCD curves further revealed the capacitive behavior of G-ink material, which is well consistent with the CV results. The specific capacitance values of G-ink are calculated using Eq. (2) based on GCD curves and the obtained values were 136.24, 128.52, 117.18 and 103.2 F g^{-1} at 2, 4, 6, and 10 A g^{-1}, respectively. The specific capacitance of G-ink was plotted against current density values, as displayed in Fig. S3(c).

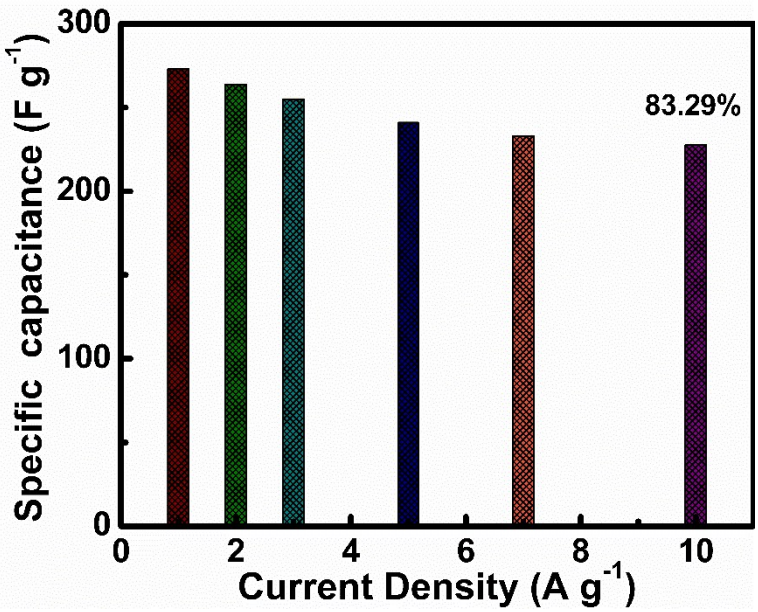

Figure S4. Specific capacitance values of FHSC

References:

[S1] http://www.mexplorer.co.kr/bbs/board.php?bo_table=grp01_eng&wr_id=34