Electronic Supplementary Material (ESI) for RSC Advances.

Pseudocapacitive-Battery like Behavior of Cobalt Manganese Nickel Sulfide (CoMnNiS) nanosheets Grown on Ni-foam by Electrodeposition for Realizing High Capacity

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Supplementary Information

Calculation

Specific capacity has been calculated using the relation below:

$$Specific\ capacity\ from\ CV\ (C) = \frac{Area\ of\ CV\ curve}{mass \times potential\ window \times scan\ rate} \qquad (1)$$

where area refers to CV scan area corresponding to a particular scan rate, mass of the material i.e. 0.2 mg and potential window which was taken 0.5.

Total current in CV scan can be expressed by sum of diffusion and capacitive current given by relation:

$$i_p(V) = i_{diff} + i_{cap} = av^b \qquad (2)$$

which can be further written as;

$$\log(i_p) = \log(a) + b\,log(v) \qquad (3)$$

where a and b are parameters, value of b is found from the slope of a linear plot of log i versus log ν which provides information about reaction kinetics of electrode taking place.

$$i_p(v) = k_1 v + k_2\sqrt{v} \quad (4)$$

where $k_1ν$ and $k_2ν$ refers to capacitive and diffusion-controlled Faradaic component of current, above relation can be rewritten as:

$$\frac{i_p(V)}{\sqrt{\vartheta}} = k_1\sqrt{v} + k_2 \quad (5)$$

Specific capacity can be calculated from GCD curve using the relation:

$$Specific\ Capacity\ by\ GCD(C) = \frac{I.\Delta t}{m \times \Delta v} \quad (6)$$

where I, Δt, m, and Δv are discharging current (A), discharging time (s), mass of HIN NiCoMnS, deposited on electrode, and the potential window respectively.

Energy density and power density of supercapacitor electrode can be calculated from the relation:

$$Energy\ density = \frac{Capacitance\ \times (potential\ window)^2}{8} \quad (7)$$

$$ED = \frac{C \times (0.37)^2}{8}$$

$$Power\ density = \frac{Energy\ density\ \times\ 3600}{discharging\ time} \quad (8)$$

$$PD = \frac{ED \times 3600}{\Delta t}$$

Materials	Specific Capacitance	Reference
$NiCo_2S_4$ Nanotube@$NiCo_2S_4$ Nanosheet Arrays	2.21 mAh cm^{-2} at 5 mA cm^{-2}	1
$NiCo_2S_4$@polypyrrole	4.94 mAh cm^{-2} at 5 mA cm^{-2}	2
$NiCo_2S_4$@Ni–Mn LDH/GS	0.97 mAh cm^{-2} at 1 mA cm^{-2}	3
$Co_xNi_{1-x}(OH)_2$/ $NiCo_2S_4$ nanotube array	1.59 mAh cm^{-2} at 4 mA cm^{-2}	4
$NiCo_2S_4$ nanotubes	0.24 mAh cm^{-2} at 5 mA cm^{-2}	5
CoMnNiS	257.4 mAh/g at 2.5 A/g or 0.10 mAh/cm^{-2} at 1 mA cm^{-2}	Our Work

Table S1 Specific capacitance of Co, Mn, Ni, and S based nanostructured electrode from literature.

References

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