Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Supplementary Information

Tuning the Synergistic Effects of MoS_2 and Spinel $NiFe_2O_4$ Nanostructures for High Performance Energy Storage and Conversion Applications

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Figures

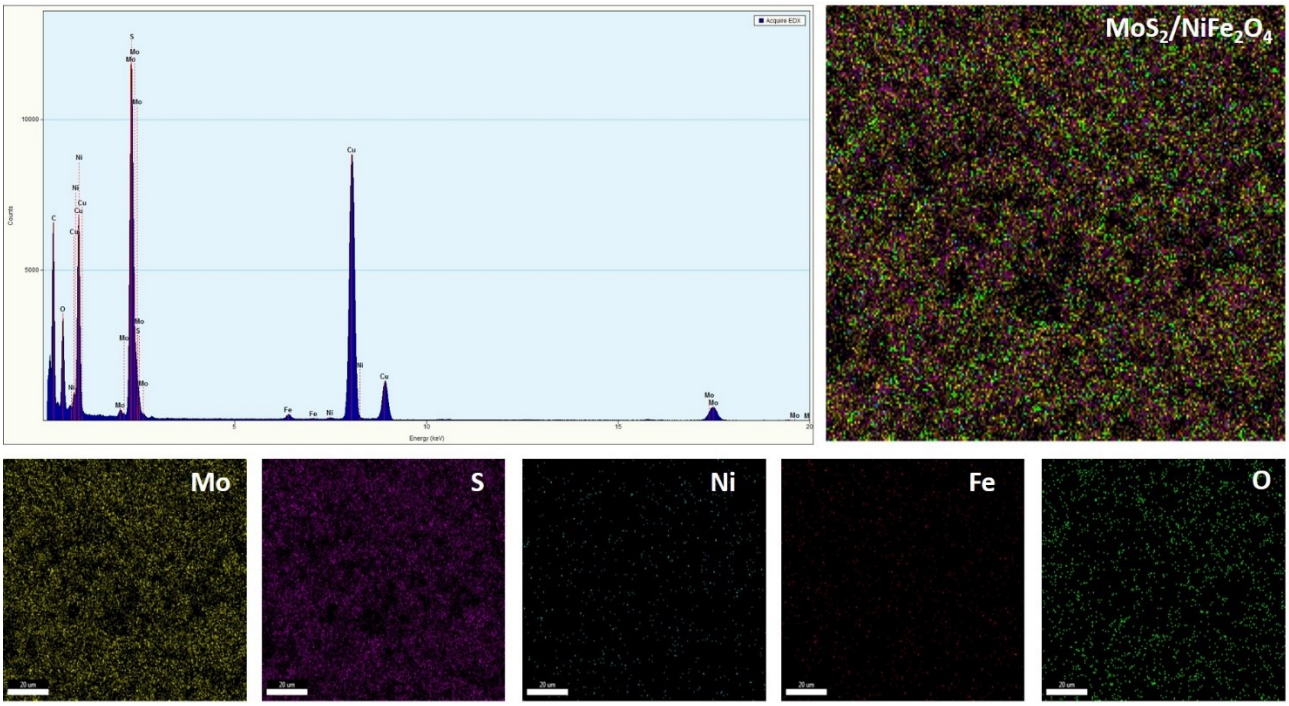

Figure S1: (a) EDS spectrum and (b) Elemental mapping image of the MN5

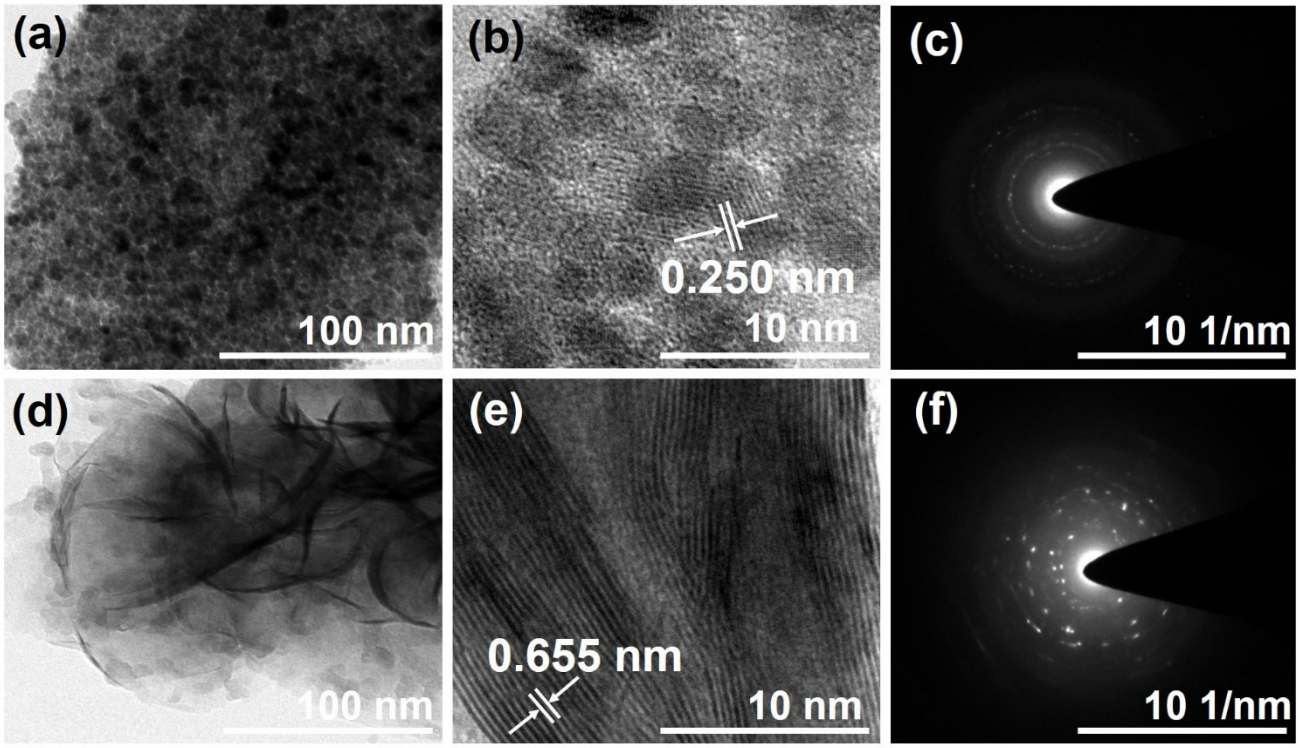

Figure S2: (a) Low (b) High resolution TEM images and (c) SAED pattern of NFO nanoparticles (d) Low (e) High resolution TEM images and (f) SAED pattern of MS nanoflowers

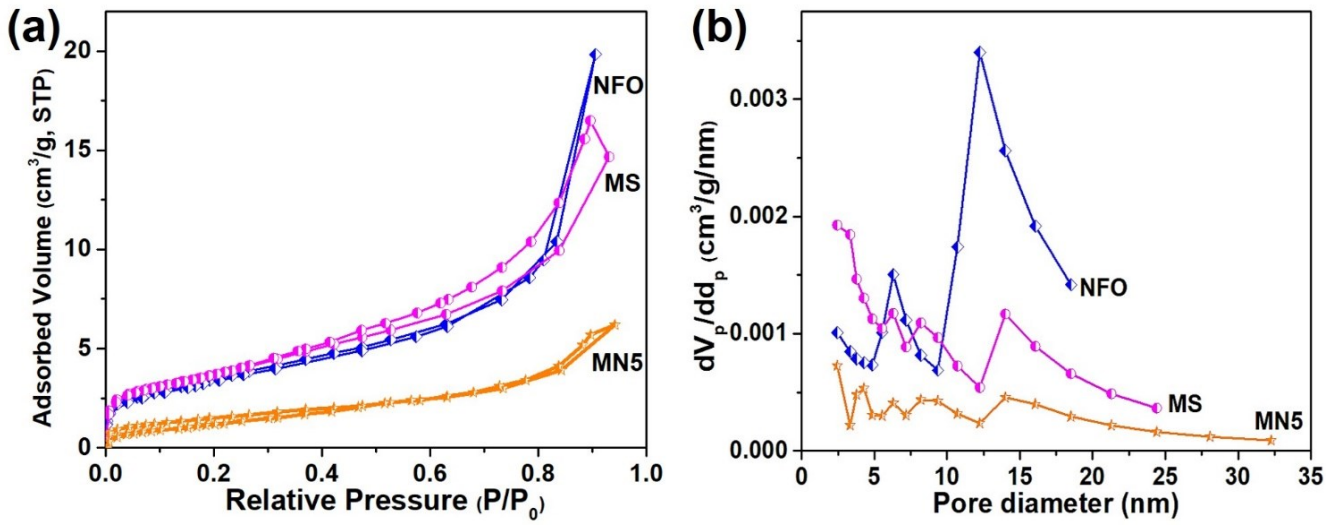

Figure S3: (a) Typical nitrogen adsorption-desorption isotherms (b) pore size distributions obtained using BJH method

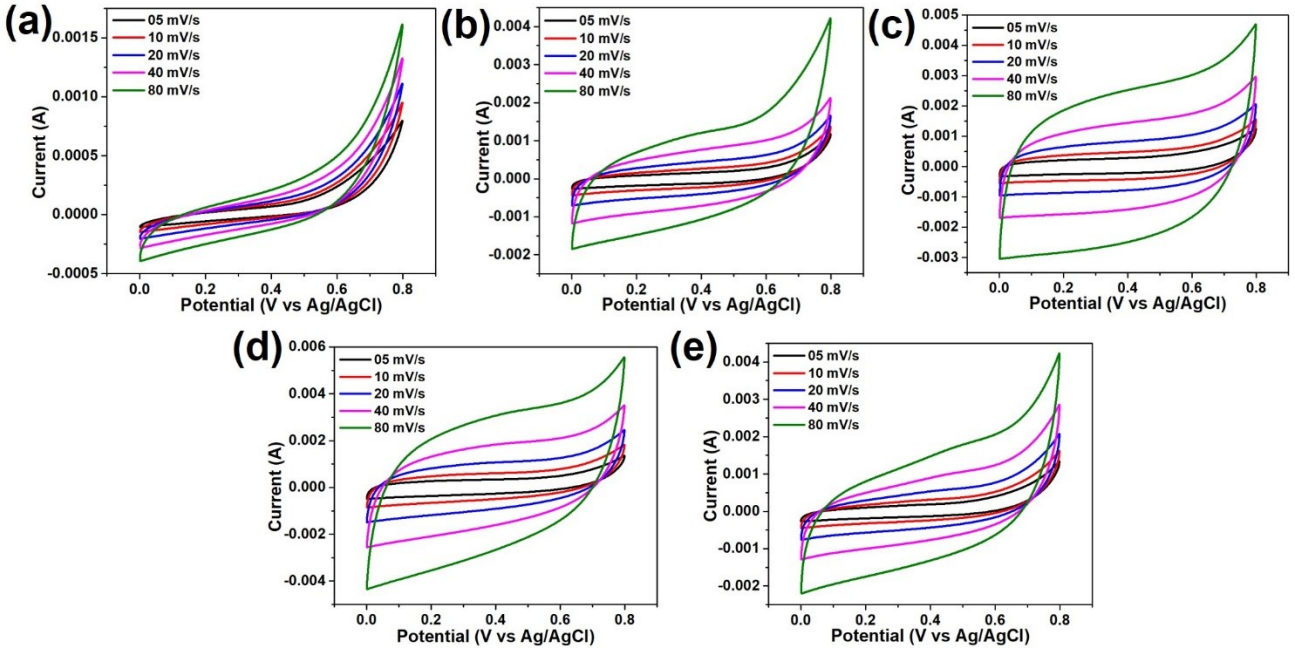

Figure S4: CV curves of (a) NFO (b) MS (c) MN1 (d) MN5 and (e) MN10

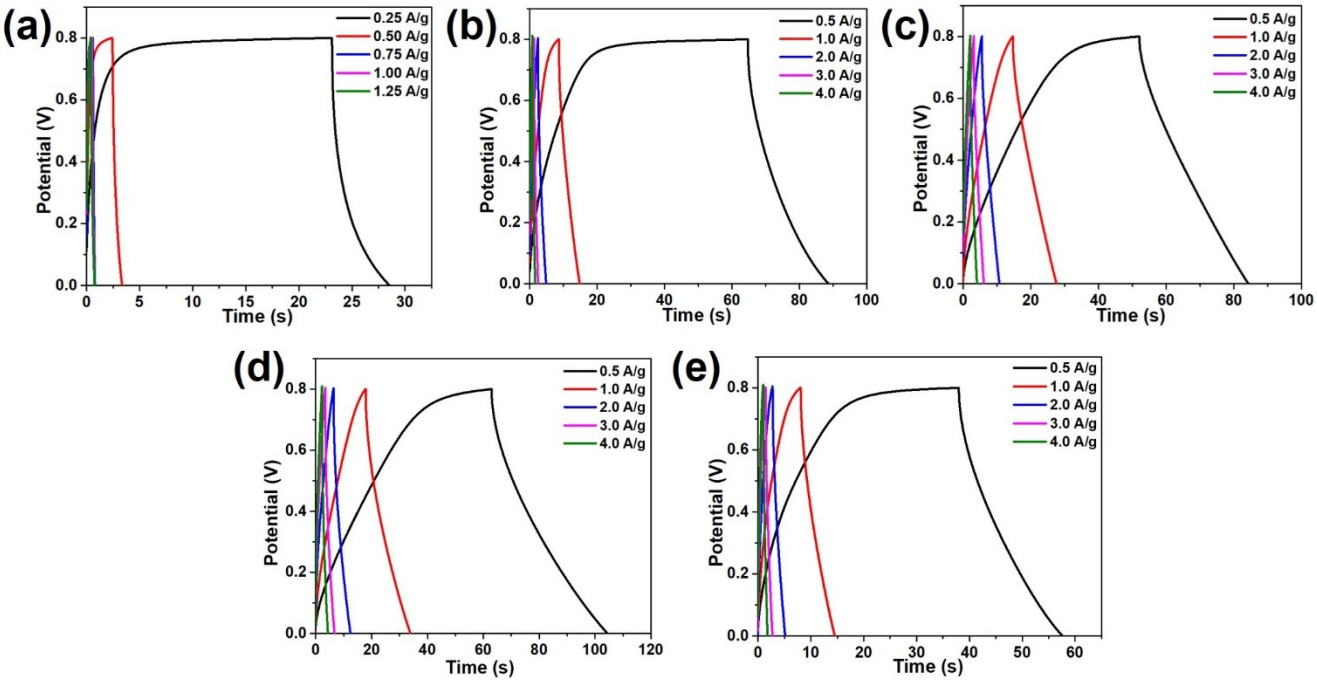

Figure S5: GCD curves of (a) NFO (b) MS (c) MN1 (d) MN5 and (e) MN10

Tables

Table ST1: Comparison of the specific capacitance, energy density, power density values of our $MoS_2/NiFe_2O_4$ nanocomposites-based electrodes with the recent literature values

Material	Electrolyte	Capacitance	Energy Density	Power Density	Ref.
MoS_2 nanoflowers	PVA- Na_2SO_4	90 F/g at 1 A/g	16.4 Wh/kg at 0.2 A/g	1.6 kW/kg at 2 A/g	1
MoS_2 nanostructures	1 M KOH	244 F/g at 1 A/g	12.2 Wh/kg at 1 A/g	-	2
MoS_2 nanosheets	1 M Li_2SO_4	47.3 F/g at 1 mA	6.56 Wh/kg at 0.5 A/g	250 W/kg at 0.5 A/g	3
MoS_2/corncob-derived activated carbon	1 M Na_2SO_4	38.3 F/g at 1 A/g	7.6 Wh/kg	608 W/kg	4
MoS_2-$Ti_3C_2T_x$	1 M H_2SO_4	115.2 F/g at 0.5 A/g	5.1 Wh/kg	298 W/kg	5
CNT@MoS_2/PDDA/PMo_{12}	1 M H_2SO_4	110 F/g at 0.5 A/g	15.27 Wh/kg	4782 W/kg	6
MoS_2 nanosheets	0.5 M $TEABF_4$	14.75 F/g at 0.5 A/g	18.43 Wh/kg at 0.75 A/g	7500 W/kg	7
AC/MoS_2	1 M Na_2SO_4	179 F/g	21 Wh/kg	225 W/kg	8
MoS_2 nanoworms	1 M Na_2SO_4	138 F/g at 1 A/g	12.26 Wh/kg	7.98 kW/kg	9
1T MoS_2	K_2SO_4	80 F/g at 5 mV/s	4.19 Wh/kg	225 W/kg	10
MoS_2/PANI/rGO	1 M H_2SO_4	97.8 F/g at 2 A/g	-	-	11
Hollow carbon-MoS_2-carbon nanoplates	1 M Li_2SO_4	248 F/g at 0.1 A/g	78 Wh/kg	3806 W/kg	12
MoS_2-NH_2/PANI	1 M H_2SO_4	58.6 F/g at 0.5 A/g	3.5 Wh/kg	14 kW/kg	13
MoS_2 /$NiFe_2O_4$ (MN5)	**1 M Na_2SO_4**	**246.68 F/g at 0.5 A/g**	**21.92 Wh/Kg at 0.5 A/g**	**1914.02 W/Kg at 0.5 A/g**	**This Wor**
			9.47 Wh/Kg at 4 A/g	**17972.10 W/Kg at 4 A/g**	

Table ST2: $MoS_2/NiFe_2O_4$ nanocomposites show the competitive electrocatalytic performances for HER compared with the current noble-metal-free catalysts

Material	Electrode	Electrolyte	Overpotential (mV) @ 10 mA/cm^2	Tafel Slope mV/dec	Ref.
$SrTiO_3$@MoS_2	Nickel Foam	1 M KOH	165	81.41	14
Ni-Fe_xP	Nickel Foam	1 M KOH	119	80	15
MoS_2-ZnO-Ni	Nickel Foam	1 M KOH	129	78	16
Cu@Ni-P@a-MoS_2	Nickel Foil	0.5 M H_2SO_4	186	60.5	17
Co_3S_4@ MoS_2-Ni_3S_2	Nickel Foam	1 M KOH	136	69	18
ZnNi–P	Nickel Foam	1 M KOH	175	129	19
NiS-$Ni_2P_2S_6$	Nickel Foam	1 M KOH	140	72.8	20
$MoS_2/NiFe_2O_4$ (MN5)	**Nickel Foam**	**0.5 M KOH**	**125**	**92.3**	**This Work**

Table ST3: Comparison of OER properties of $MoS_2/NiFe_2O_4$ catalysts with relevant catalytic materials

Material	Electrode	Electrolyte	Overpotential	Tafel Slope mV/dec	Ref.
VOx/NiS	Nickel Foam	1 M KOH	330 mV at 50 mA/cm^2	121	21
Fe-Co_9S_8	Nickel Foam	1 M KOH	270 mV at 10 mA/cm^2	70	22
CuCo-Ni_3S_2	Nickel Foam	1 M KOH	400 mV at 100 mA/cm^2	94.9	23
$NiCo_2O_4$	Nickel Foam	1 M KOH	271 mV at 10 mA/cm^2	172	24
$MoS_2/NiCo_2O_4$	Nickel Foam	1 M KOH	322 mV at 50 mA/cm^2	113	25
Ni_3S_2 NWs	Nickel Foam	1 M KOH	317 mV at 10 mA/cm^2	53.3	26
$MoS_2/NiFe_2O_4$ (MN5)	**Nickel Foam**	**0.5 M KOH**	**300 mV at 50 mA/cm^2**	**96.4**	**This Work**

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