

One-step preparation of 3D hydrangea-like nickel sulfide films as an electrocatalyst for efficient dye-sensitized solar cells

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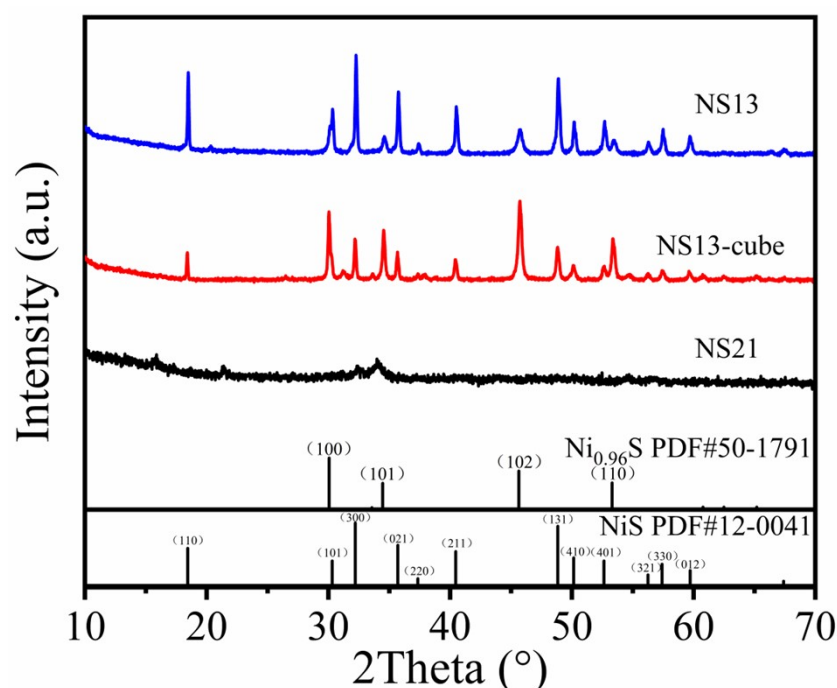


Fig. S1. XRD spectra of the various solvothermal products.

Table S1. Relative weight percentage of β -NiS and $\text{Ni}_{0.96}\text{S}$ phase in NS13 cube and NS13 CEs

CE	$\text{Ni}_{0.96}\text{S}$ (wt%)	NiS (wt%)
NS13	28.90	71.10
NS13-cube	46.13	53.87

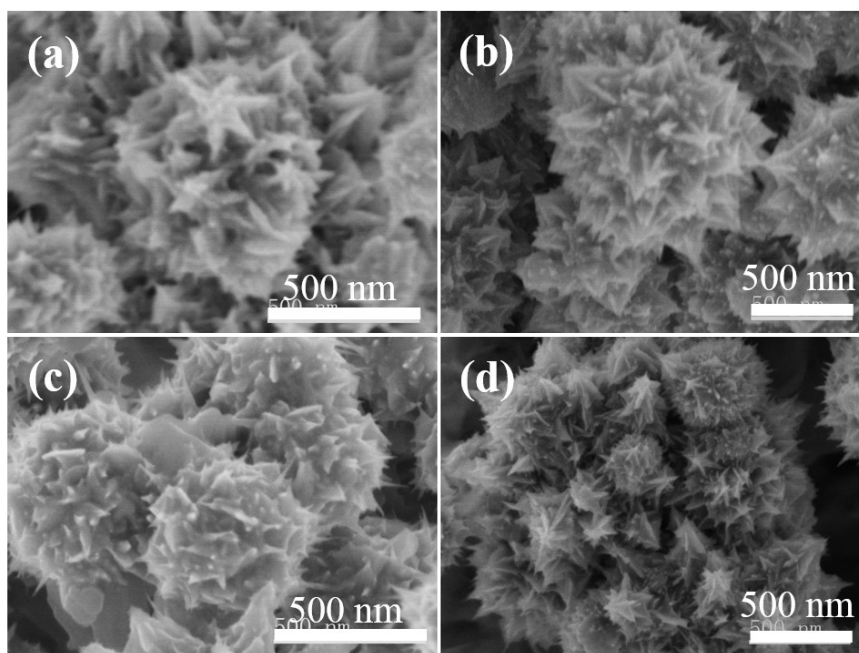


Fig. S2. SEM images for NS21 5 h (a), NS21 10 h (b), NS11 5 h (c), and NS11 10 h (d).

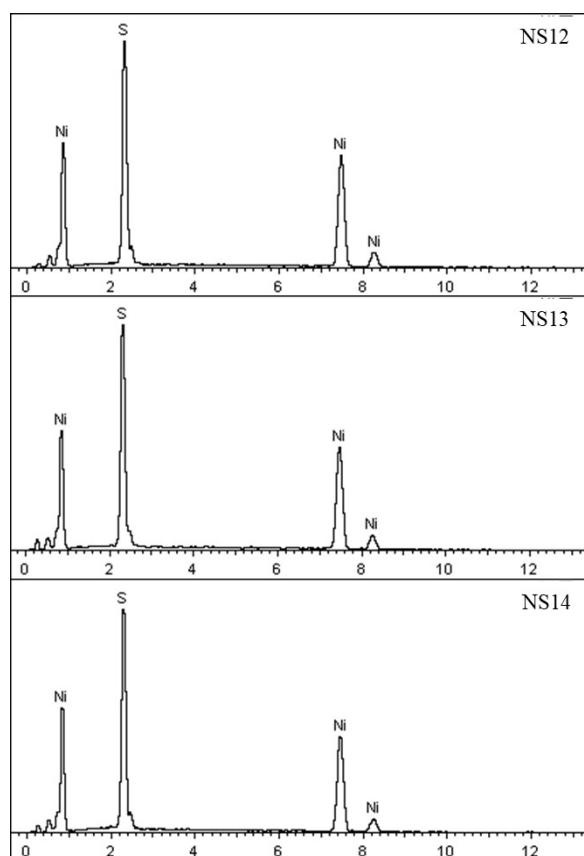


Fig. S3. EDX spectra of the prepared samples.

Table S2. EDX elemental ratios of Ni to S.

sample	Ni (At%)	S (At%)	Ni:S
NS12	50.83	49.17	1:0.96
NS13	49.62	50.38	1:1.01
NS14	47.34	52.66	1:1.11

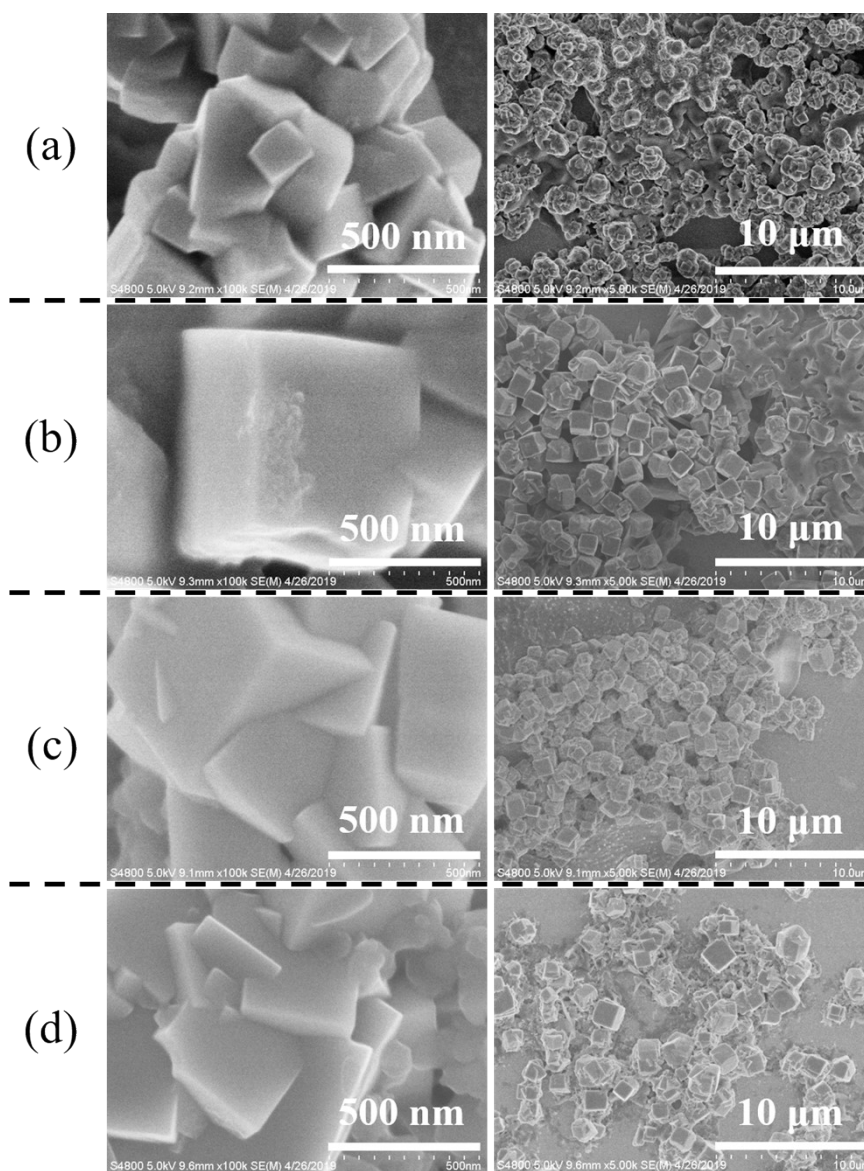


Fig. S4. SEM topographies of samples prepared from different solvents with ethanol to water ratios of (a) 2:1, (b) 1:1, (c) 1:2 and (d) 0:1.

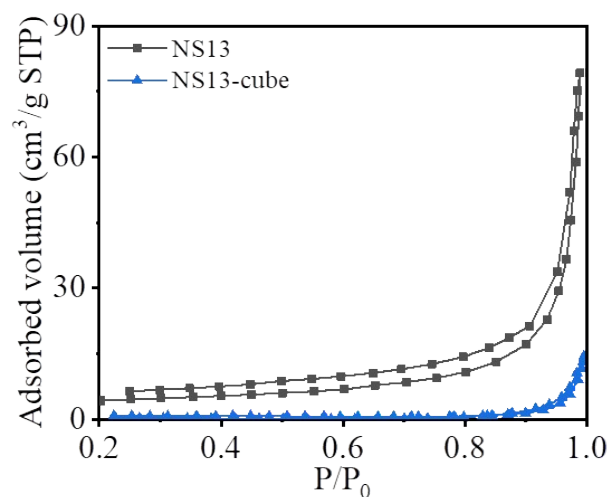


Fig. S5. N₂ adsorption-desorption isotherms of NS13 and NS13-cube.

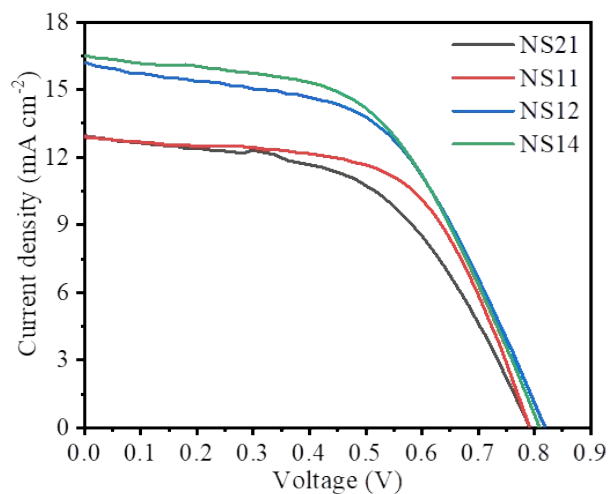


Fig. S6. *J-V* curves of DSSCs based on NS12 and NS14 CEs.

Table S3. Photovoltaic performance characteristics of DSSCs based on NS21, NS11, NS12 and NS14 CEs.

CE	J_{SC} (mA cm ⁻²)	V_{OC} (V)	FF	PCE (%)
NS21	12.96	0.78	0.54	5.43
NS11	12.90	0.78	0.61	6.16
NS12	16.21	0.81	0.54	7.03
NS14	16.51	0.81	0.53	7.15

Table S4. A summary of DSSC based on various NiS electrodes.

Materials	Fabrication methods	PCE	Ref.
NiS/PCC	Carbonization process	6.80%	R1
NiS submicron cubes	Hydrothermal synthesis method	6.40%	R2
NiS/TiO ₂	Hydrothermal synthesis method	5.63%	R3
Nanoporous NiS	Electrodeposition method	6.77%	R4
NiS-NWs-350	Ion exchange reaction method	7.56%	R5
Flower-like NiS	Hydrothermal synthesis method	7.10%	R6
NiS/GO-ppy	Two-step electrochemical deposition method	6.32%	R7
4-ATP / NiS	Two-step chemical/electrochemical process	7.20%	R8
CN-NiS/TiO ₂	Hydrothermal synthesis method	6.65%	R9
NiS with treatment	H ₂ S hydrothermal treatment	7.37%	R10
NiS/graphene	Chemical vapor deposition	5.25%	R11
NiS/MoS ₂	Straightforward chemical synthesis	7.50%	R12
NS13	One-step solvothermal method	7.64%	This work

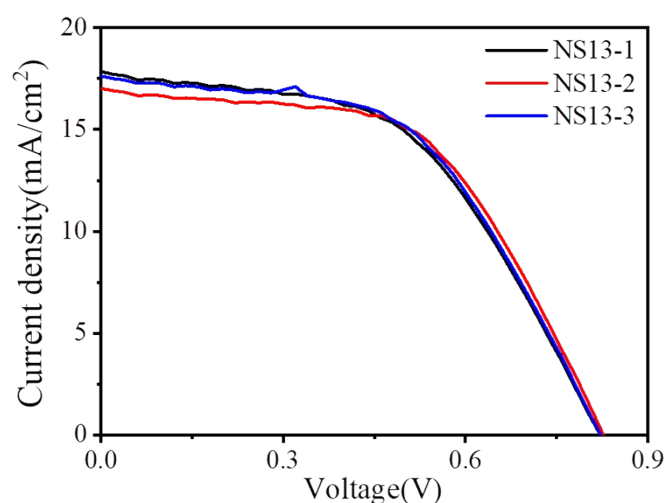


Fig. S7. *J-V* curves of DSSCs based on various NS13 CEs.