

Supporting Information

Improving electrocatalytic activity and stability of spinel sulfide counter electrodes by trimetallic synergy effects for quantum dot sensitized solar cells

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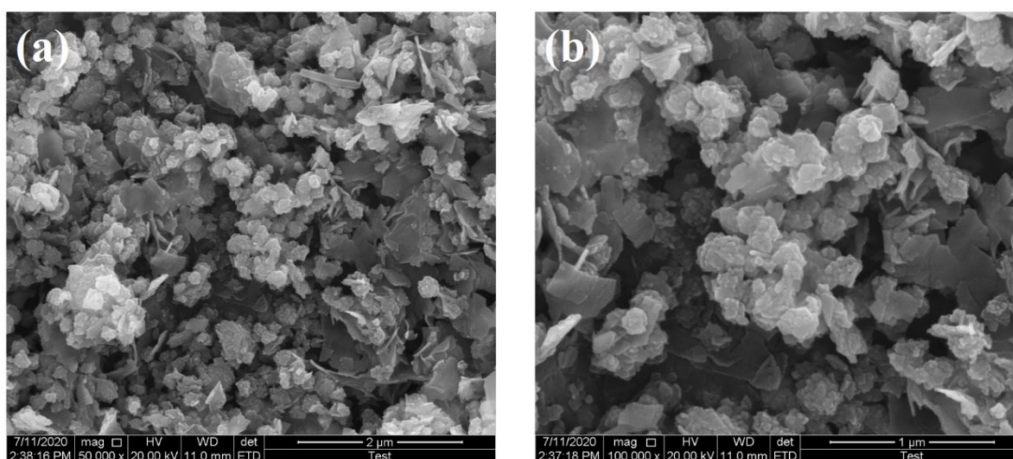


Fig. S1 (a-b) SEM images of $\text{Mn}_{0.5}\text{Ni}_{0.5}\text{Co}_2\text{S}_4$.

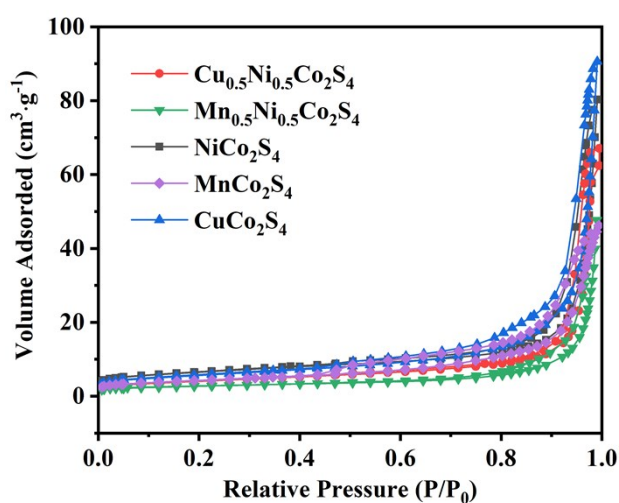


Fig. S2 Nitrogen adsorption/desorption isotherm of samples.

Table S1 BET surface areas of Samples

Sample	Specific surface area ($\text{m}^2 \cdot \text{g}^{-1}$)
$\text{Cu}_{0.5}\text{Ni}_{0.5}\text{Co}_2\text{S}_4$	14.59
$\text{Mn}_{0.5}\text{Ni}_{0.5}\text{Co}_2\text{S}_4$	9.30
NiCo_2S_4	22.42
MnCo_2S_4	14.90
CuCo_2S_4	19.87

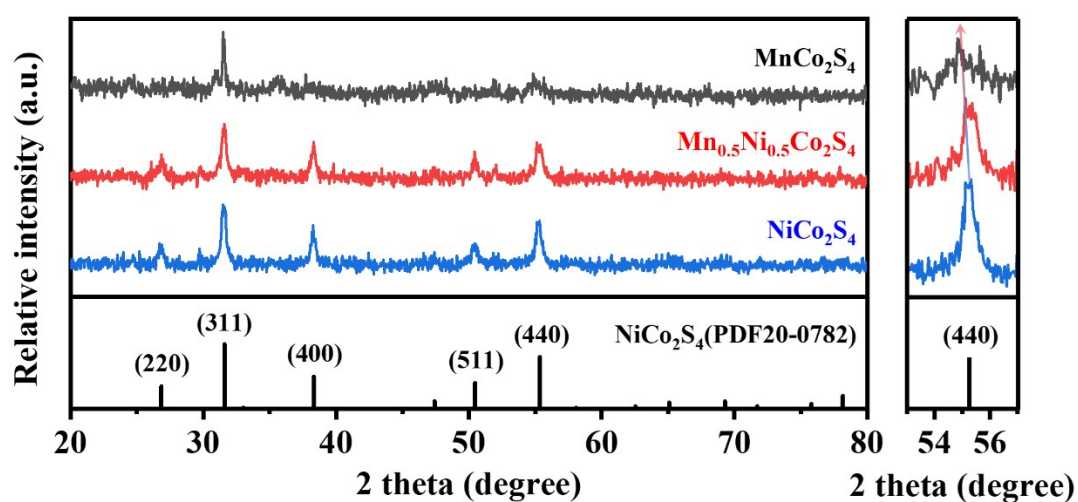


Fig. S3 XRD patterns of MnCo_2S_4 , $\text{Mn}_{0.5}\text{Ni}_{0.5}\text{Co}_2\text{S}_4$ and NiCo_2S_4 .

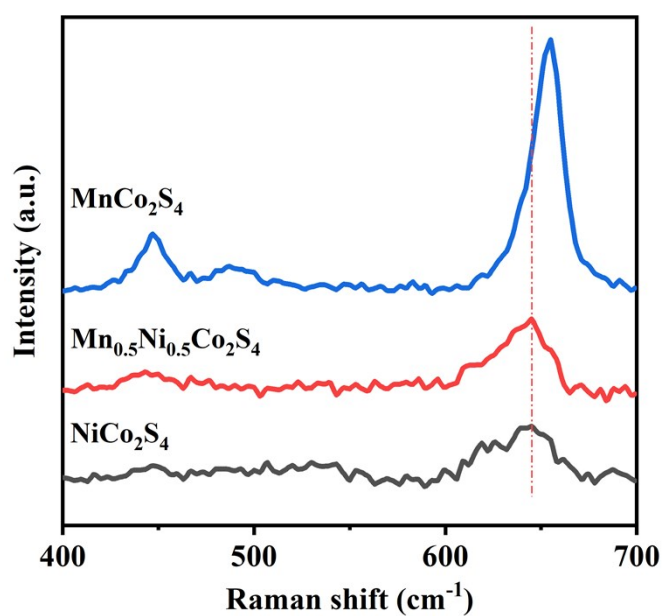


Fig. S4 Raman spectra of MnCo_2S_4 , $\text{Mn}_{0.5}\text{Ni}_{0.5}\text{Co}_2\text{S}_4$ and NiCo_2S_4 .

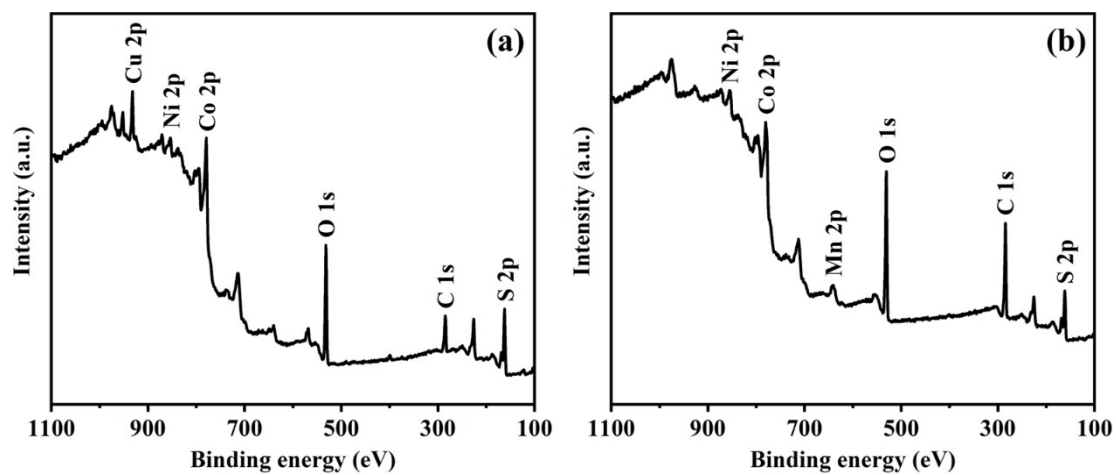


Fig. S5 XPS survey spectrum of (a) $\text{Cu}_{0.5}\text{Ni}_{0.5}\text{Co}_2\text{S}_4$ and (b) $\text{Mn}_{0.5}\text{Ni}_{0.5}\text{Co}_2\text{S}_4$.

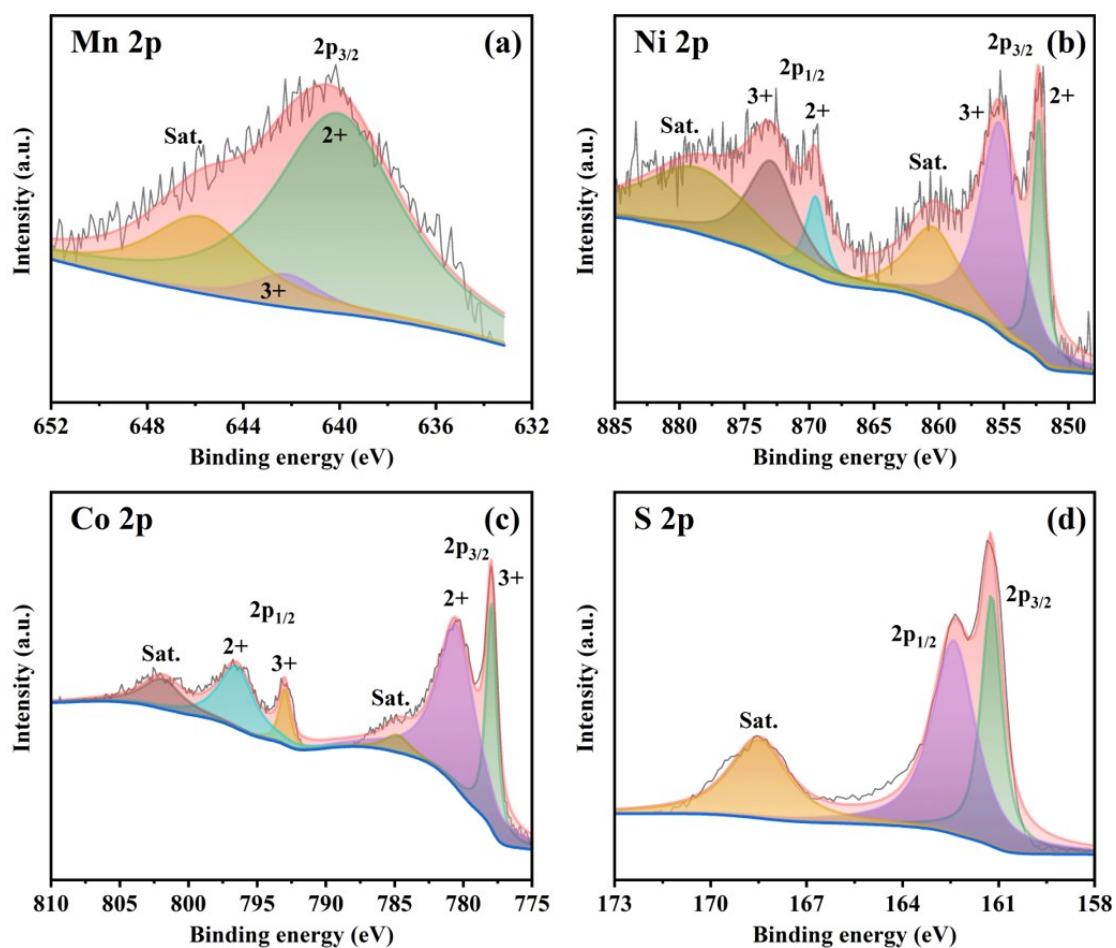


Fig. S6 High-resolution XPS of (a) Mn 2p, (b) Ni 2p, (c) Co 2p and (d) S 2p of $\text{Mn}_{0.5}\text{Ni}_{0.5}\text{Co}_2\text{S}_4$.

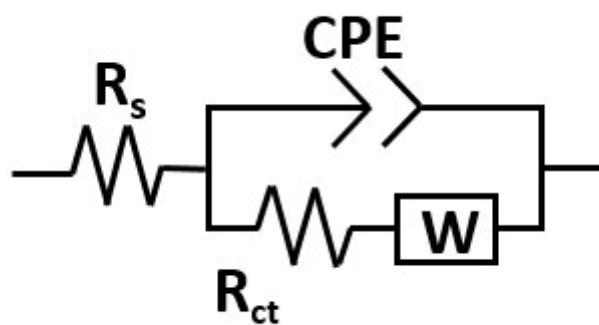


Fig. S7 The equivalent circuit of EIS Nyquist plots.

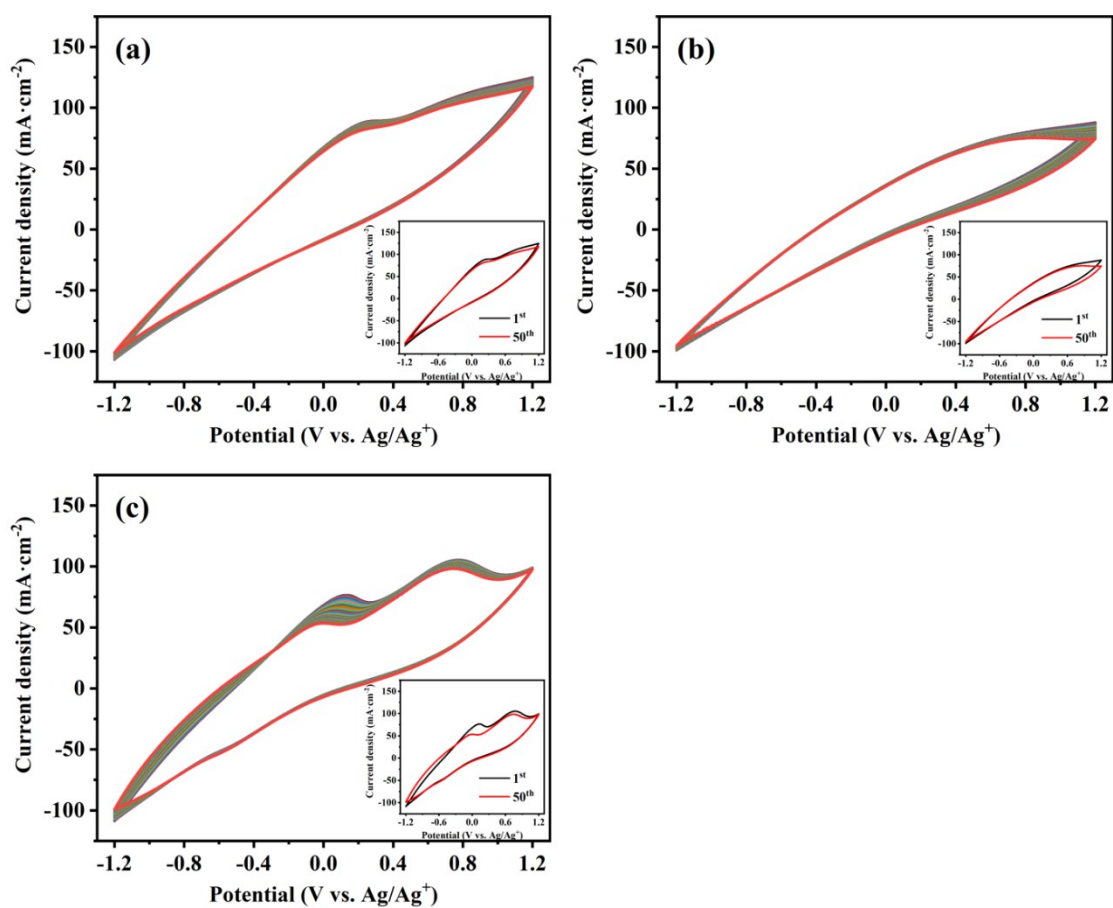


Fig. S8 Fifty successive CV cycles for (a) $\text{Mn}_{0.5}\text{Ni}_{0.5}\text{Co}_2\text{S}_4$, (b) MnCo_2S_4 and (c) NiCo_2S_4 in polysulfide electrolyte.