IOCM 2025 Conference

The 4th International Online Conference on Materials

3–6 November 2025 | Online

MDPI

Highly Efficient and Durable NiFeSSe Electrocatalyst for Hydrogen Evolution in Acidic Media

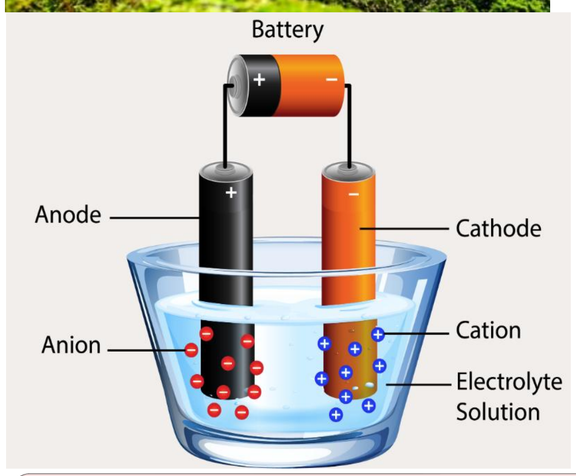
Rajni Thakur[a], Rohit Kumar[a], Samriti Mehta[a], R. Geetha Balakrishna[b], Shwetharani R[b]*, Itika Kainthla[a]*,

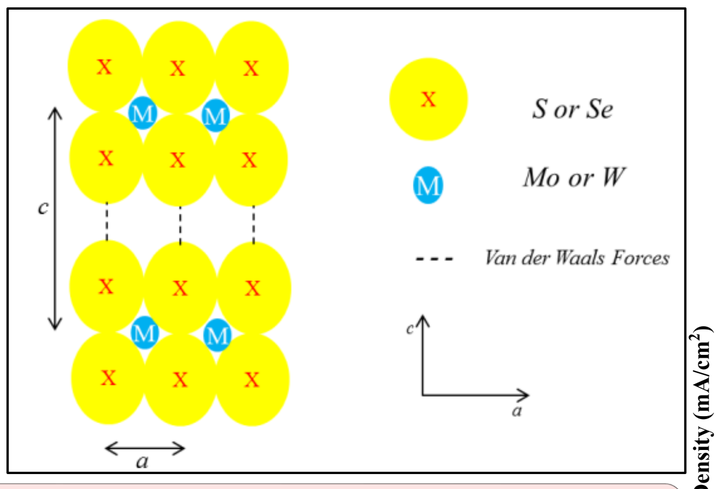
[a]School of Physics and Materials Science, Shoolini University, Bajhol, Himachal Pradesh 173229, India

[b]Centre for Nano and Material Sciences (CNMS), Jain (Deemed-to-be University), Kanakapura, Ramanagara, Karnataka 562112, India

INTRODUCTION & AIM

Sustainable Development Goals





AIM: ***Synthesis and characterization of NiFeSSe by the Hydrothermal method for Hydrogen Evolution Reaction (HER)***

METHOD

Transition metal dichalcogenide-based electrocatalysts

❖ **Prepared Samples:**

I. **NiSSe**

II. **FeSSe**

III. **$Ni_{0.25}Fe_{0.75}SSe$**

IV. **$Ni_{0.5}Fe_{0.5}SSe$**

V. **$Ni_{0.75}Fe_{0.25}SSe$**

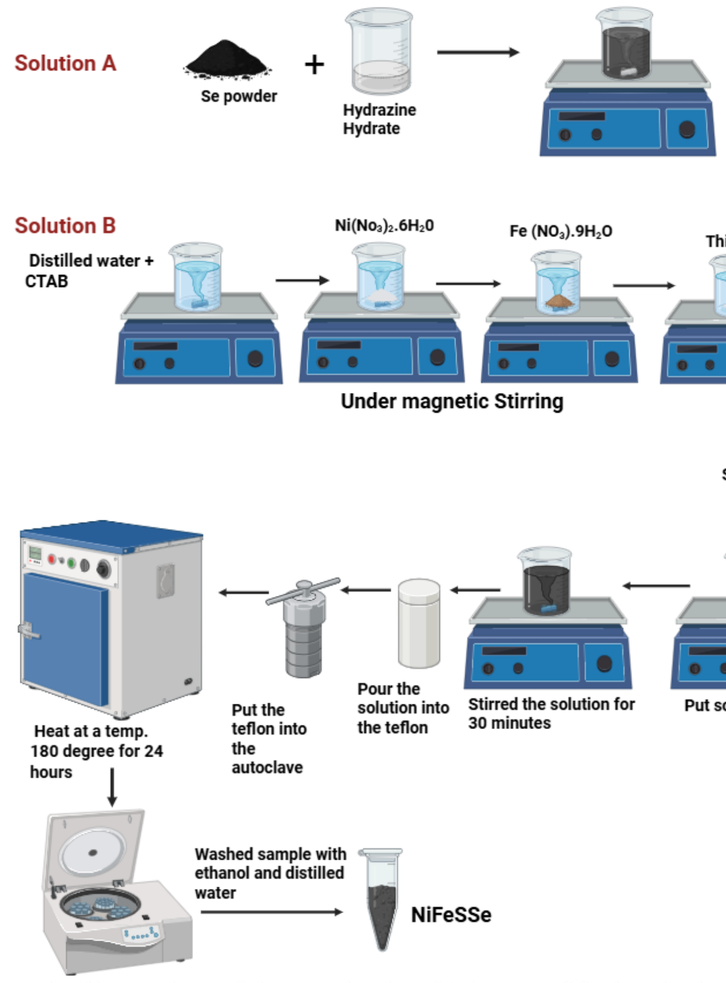


Figure 1. Schematic illustration of the synthesis of $Ni_{(1-x)}Fe_xSSe$ by the hydrothermal method.

RESULTS & DISCUSSION

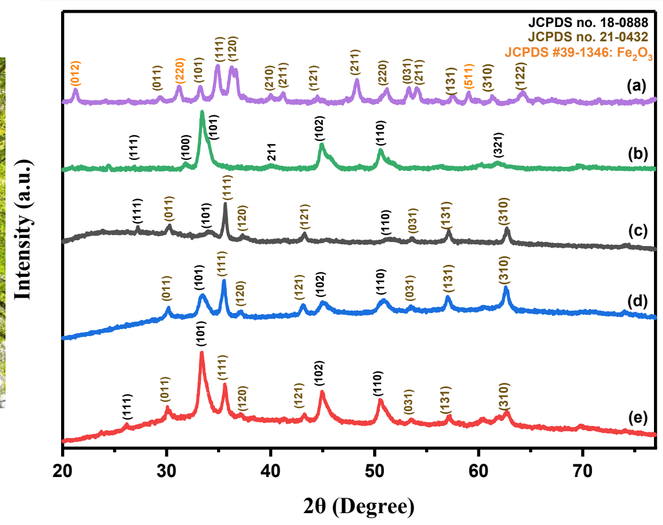


Figure 2. X-ray diffraction patterns of (a) FeSSe, (b) NiSSe (c) $Ni_{0.25}Fe_{0.75}SSe$, (d) $Ni_{0.5}Fe_{0.5}SSe$, and (e) $Ni_{0.75}Fe_{0.25}SSe$

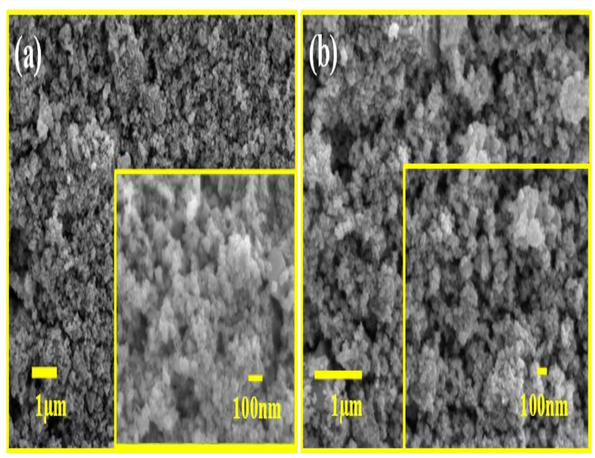


Figure 3. FE-SEM image of $Ni_{0.25}Fe_{0.75}SSe$

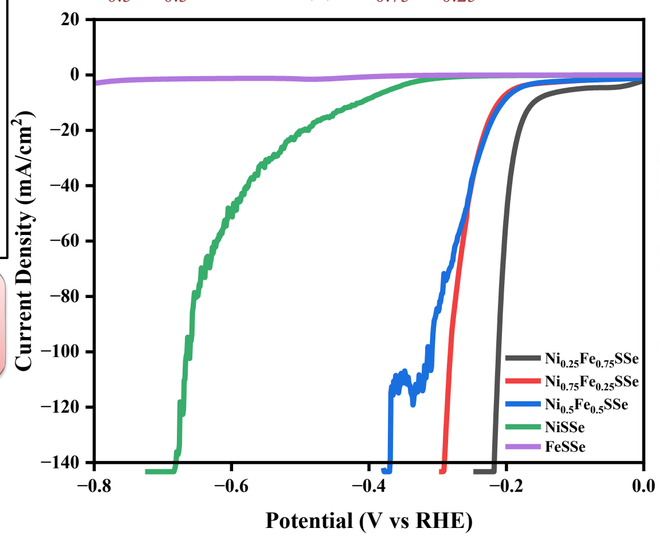


Figure 4. Linear sweep voltammetry graphs of FeSSe (868), NiSSe (414), $Ni_{0.25}Fe_{0.75}SSe$ (158), $Ni_{0.5}Fe_{0.5}SSe$ (205), and $Ni_{0.75}Fe_{0.25}SSe$ (210)

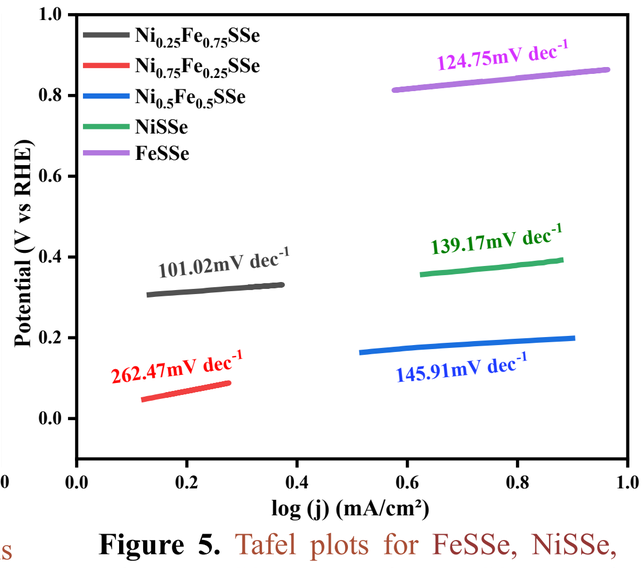


Figure 5. Tafel plots for FeSSe, NiSSe, $Ni_{0.25}Fe_{0.75}SSe$, $Ni_{0.5}Fe_{0.5}SSe$, and $Ni_{0.75}Fe_{0.25}SSe$

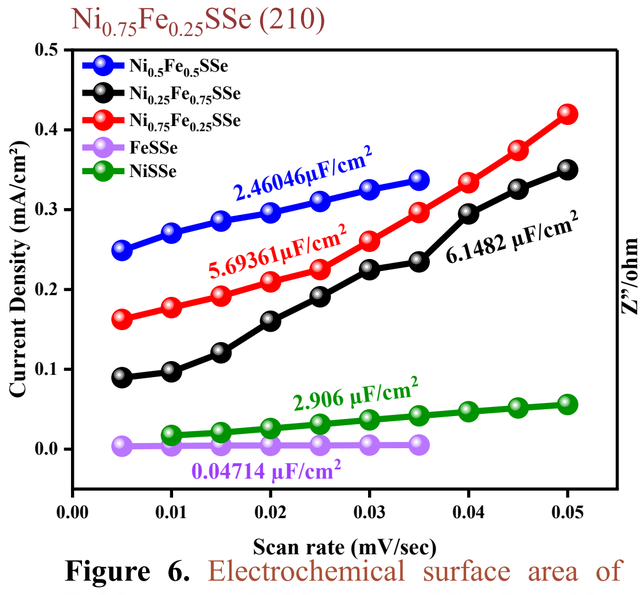


Figure 6. Electrochemical surface area of FeSSe, NiSSe, $Ni_{0.25}Fe_{0.75}SSe$, $Ni_{0.5}Fe_{0.5}SSe$, and $Ni_{0.75}Fe_{0.25}SSe$

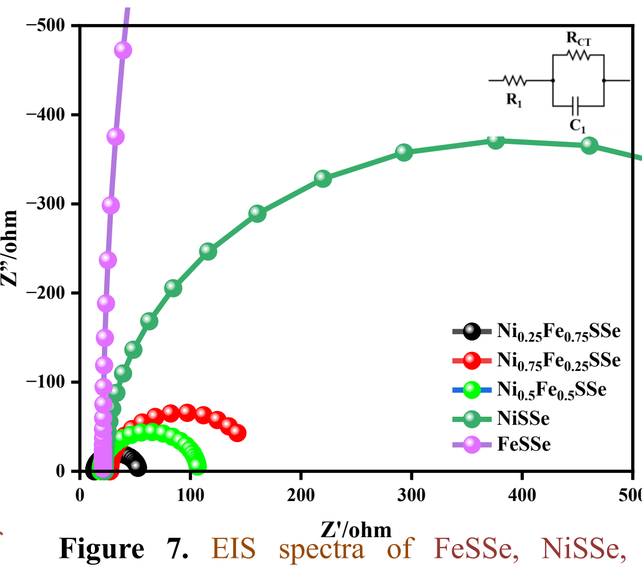


Figure 7. EIS spectra of FeSSe, NiSSe, $Ni_{0.25}Fe_{0.75}SSe$, $Ni_{0.5}Fe_{0.5}SSe$, and $Ni_{0.75}Fe_{0.25}SSe$

CONCLUSION

Thus, we concluded that $Ni_{0.25}Fe_{0.75}SSe$ performed better than other prepared electrocatalysts in terms of HER activity. Because it has a low overpotential of 158 mV and a high ECSA of 175.66 cm^2.

FUTURE WORK / REFERENCES

Future work will focus on integrating NiFeSSe with CNT boost conductivity and HER efficiency

Thakur, R., Kumar, R., Mehta, S., Balakrishna, R.G., and Kainthla, I., Transition Metal Synergy and Chalcogen Coordination in $Ni_{(1-x)}Fe_xSSe$ for Superior Hydrogen Evolution Activity.