# Supporting Information

# Enhancing the activity and stability of the $Cu_2O$ nanorods via coupling with $NaNbO_3/SnS_2$ heterostructure for photoelectrochemical water splitting

Shalini Tiwari[1], Priyanka Yadav[1] and Ashok K. Ganguli[1,2]

[1]Department of Chemistry, Indian Institute of Technology Delhi

[2]Department of Materials Science and Engineering, Indian Institute of Technology Delhi

New Delhi 110016, India

* Author for correspondence

Email: ashok@chemistry.iitd.ernet.in

**Figure S1** High-Resolution Transmission Electron Microscopy (HRTEM)

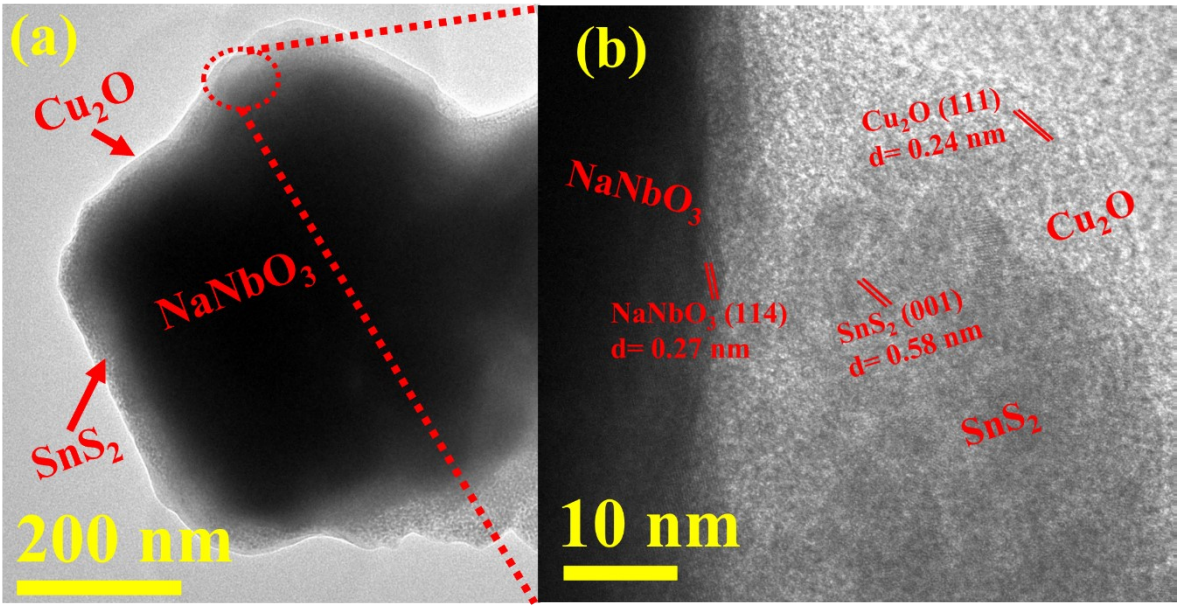



**Figure S1** (a) TEM image and (b) HRTEM image of the $NaNbO_3/SnS_2/Cu_2O$ heterostructure.

**Table S1** Calculated conduction and valence band edge positions:

| S.No. | Material | Valence band | Conduction Band |
|---|---|---|---|
| S.No. | Photocatalyst | | Current density, light-dark ($mA/cm^2$) |
| 1. | $NaNbO_3$ | 2.98 eV | -0.48 eV |
| 2. | $SnS_2$ | 1.50 eV | - 0.96 eV |
| 3. | $Cu_2O$ | 0.30 eV | -1.75 eV |

S2: Calculation of the electron affinity potential of the semiconductor materials by the following formula:

$$\mathbf{X = 0.5\ (E_{EA} + E_{ion})}$$

Here, $E_{EA}$ = Energy of electron affinity and $E_{ion}$ = First Ionization Energy

For $NaNbO_3$, $X_{Na}$ = 3.04 eV, $X_{Nb}$ = 4.035 eV and $X_O$ = 8.05 eV, $X_{NaNbO3}$ = 5.73 eV

For $Cu_2O$, $X_{Cu}$ = 2.81 eV, $X_O$ = 8.05 eV, $X_{Cu2O}$ = 3.99 eV

For $SnS_2$ $X_{Sn}$ = 3.45 eV, $X_O$ = 8.05 eV, $X_{SnS2}$ = 4.57 eV

**Table S2** Calculated the difference in current density of the photocatalyst between light and dark irradiation.

| | | |
|---|---|---|
| 1. | $NaNbO_3/SnS_2/Cu_2O$ | 6.50 |
| 2. | $NaNbO_3/SnS_2$ | 0.84 |
| 3. | $SnS_2$ | 0.35 |
| 4. | $NaNbO_3$ | 0.18 |
| 5. | $Cu_2O$ | 0.13 |

**Figure S2** Linear Sweep Voltammetry plots of $NaNbO_3/SnS_2/Cu_2O$ heterostructure.

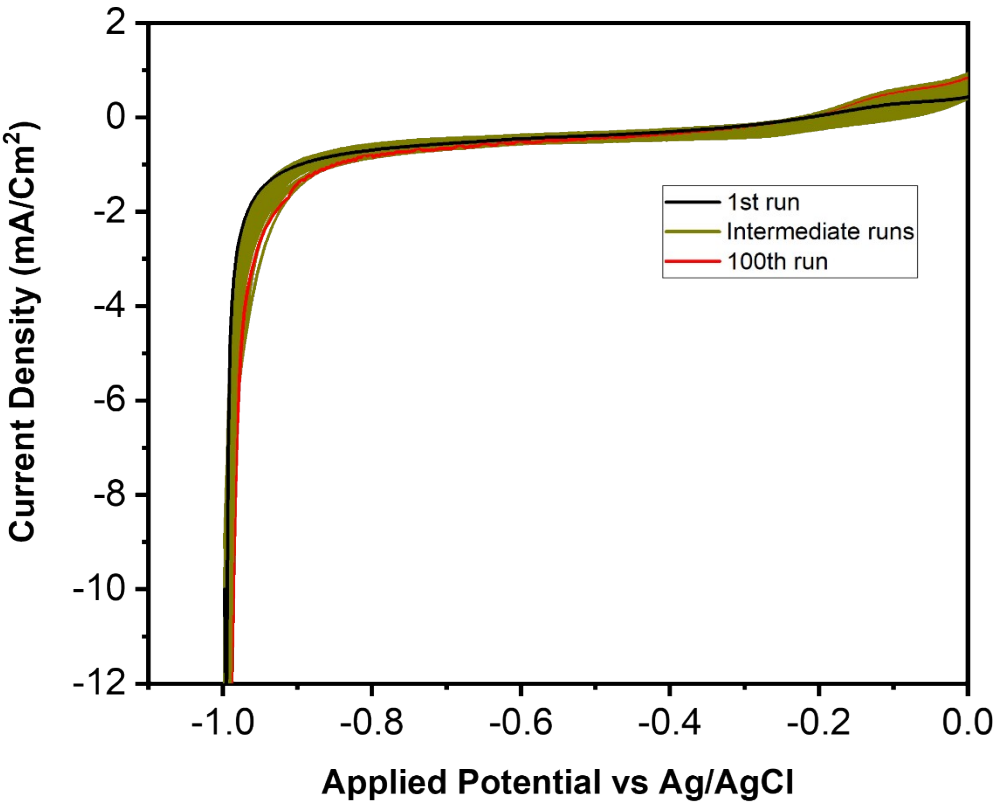



**Figure S3** Faradaic Efficiency of the photocatalyst of $NaNbO_3/SnS_2/Cu_2O$, $NaNbO_3/SnS_2$ and $Cu_2O$.

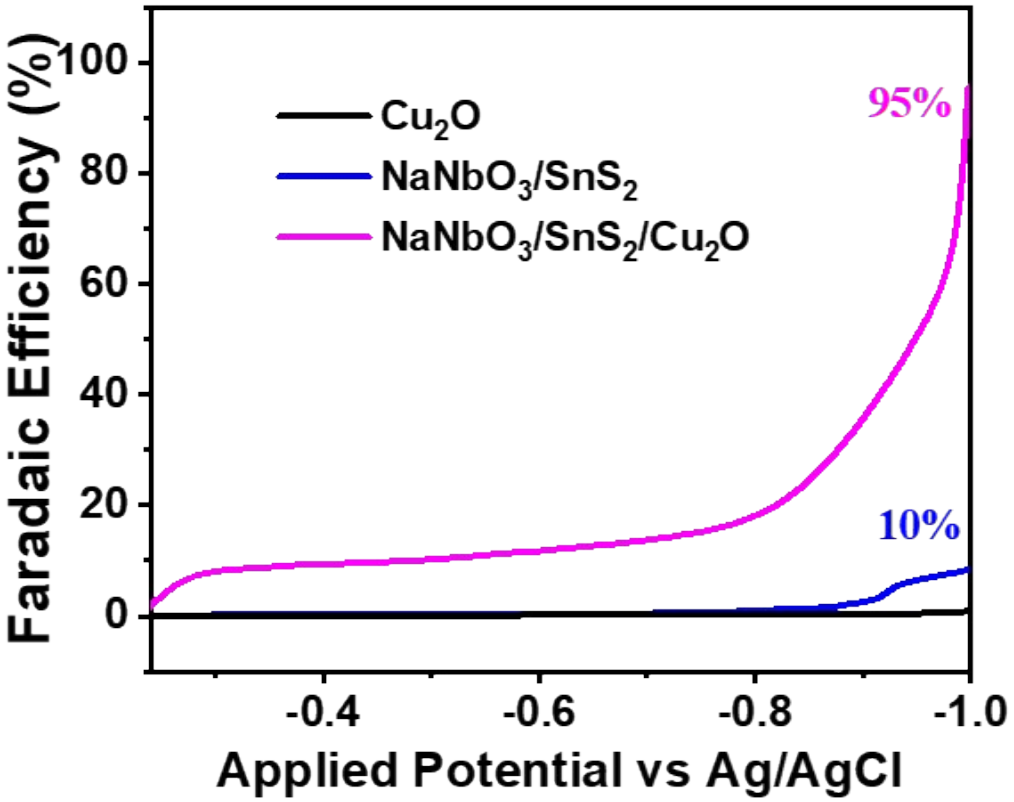
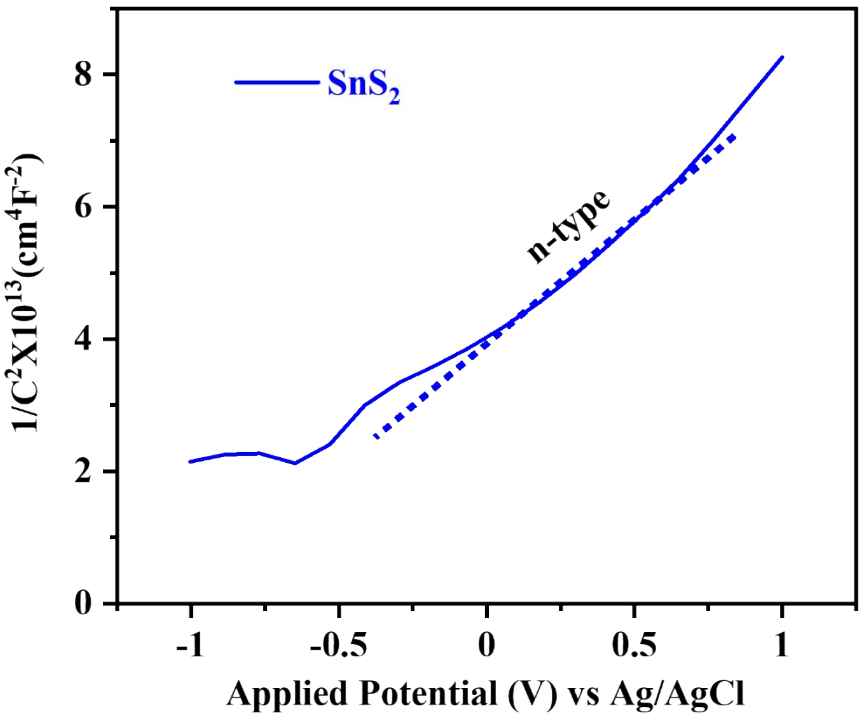



**Figure S4** Mott-Schottky plot of $SnS_2$


SnS2
n-type
1/C2X1013(cm4F-2)
8
6
4
2
0
-1
-0.5
0
0.5
1
Applied Potential (V) vs Ag/AgCl