# Supporting Information

**Coupling of Piezoelectric, Semiconducting and Photoexcitation Properties in $NaNbO_3$ Nanostructures for Controlling Electrical Transport: Realizing an Efficient Piezo-Photoanode and Piezo-Photocatalyst**

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### X-ray Photoelectron Spectroscopy

X-ray photoelectron spectroscopy (XPS) measurements were performed on $NaNbO_3$ sample using (Specs, German company) spectrometer with Mg $k_\alpha$ X-ray source (1253.6 eV). Ultra high vacuum (~ $10^{-9}$ mbar) was maintained in the main XPS chamber during all the measurements. The binding energies were determined by taking C 1s line (284.6 eV) as reference. Fig. S1 shows wide range survey scan and core level XPS scans of Na 1s, Nb 3d and O 1s states.

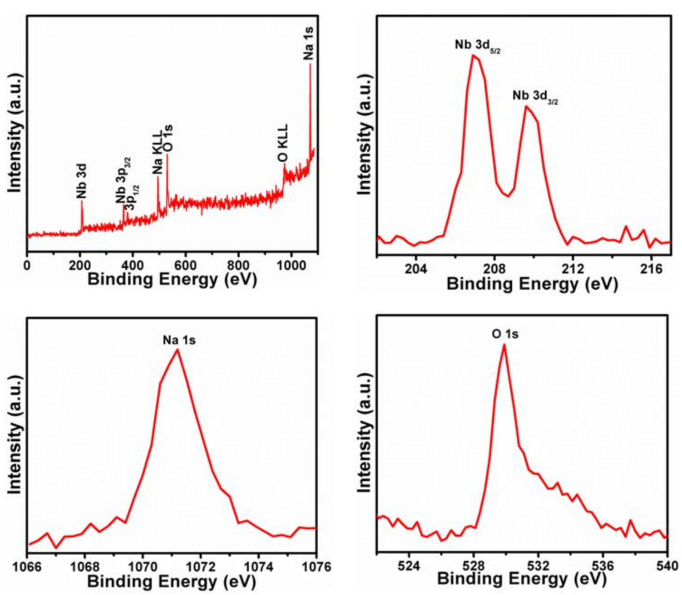


**Fig. S1.** Wide range XPS scan of $NaNbO_3$ film. Binding energies for Na (1s), Nb (3d) and O (1s) states are shown.

The high resolution spectrum of Nb 3d exhibits spin-orbit doublet with Nb $3d_{5/2}$ and Nb $3d_{3/2}$ at binding energies ~207.1 eV and ~209.8 eV respectively corresponding to +5 oxidation state of Nb element. The high resolution spectrum for Na 1s and O 1s exhibit peaks at binding energies ~1071.1 eV and ~529.8 eV corresponding to +1 and -2 oxidation states of the respective elements. Thus, XPS results confirm elemental composition with exact oxidation state which demonstrates that no impurity phase is formed in the synthesis of $NaNbO_3$.

**Rietveld Refinement of $NaNbO_3$ XRD Data**

Fig. S2 depicts Rietveld refinement of $NaNbO_3$ X-ray diffraction data. The refined data confirms formation of orthorhombic structure with $P2_1ma$ space group. The lattice parameters obtained from refined data are; a= 5.565 Å, b= 7.776 Å, c= 5.514 Å.

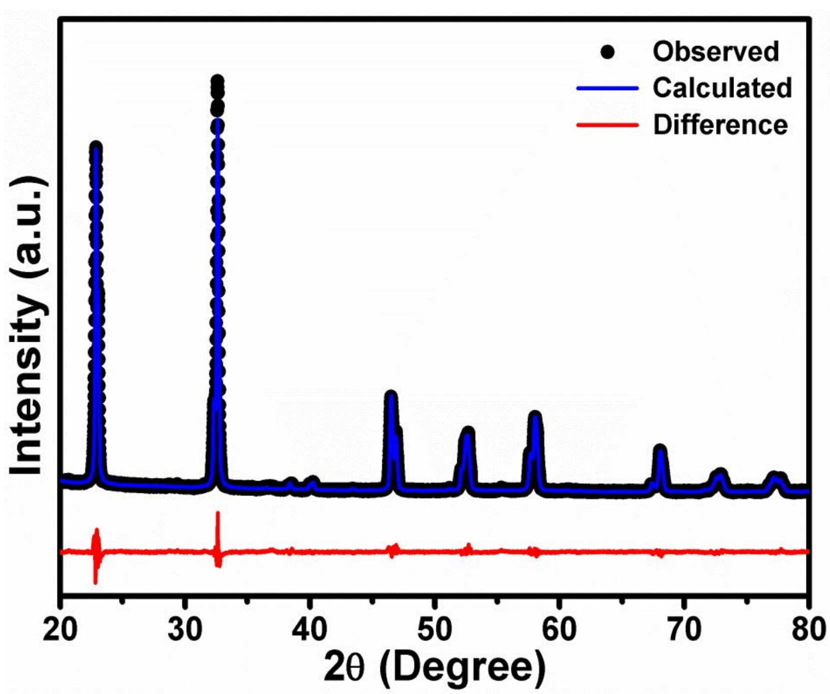


**Fig. S2.** Refined XRD data of $NaNbO_3$ nanostructures. Symbol (▪) represents experimental data points and the solid line (blue) represents the fitted curve after the refinement. The difference between the observed and calculated results is shown below with solid line (red).

**Current-voltage Characteristics of $NaNbO_3$ Nanostructure Film**

Fig. S3 depicts I-V characteristics of $NaNbO_3$ nanostructure film coated onto ITO substrate. An ohmic behavior is observed. The resistance of the $NaNbO_3$ nanostructure film is estimated as ~ 40 kΩ. This value is large as compared to the resistance observed in ZnO nanostructure films.

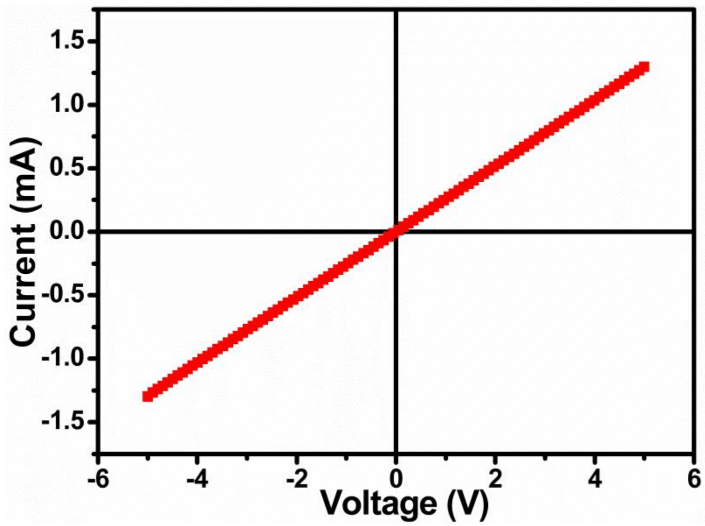


**Fig. S3.** I-V characteristics of $NaNbO_3$ nanostructure film.

**Experimental Setup for Studying Piezo-Photoelectrochemical Activity**

Fig. S4 shows an experimental setup used for studying piezo-photoelectrochemical activity. The three electrode assembly (containing $NaNbO_3$ working electrode, Pt counter electrode and Ag/AgCl reference electrode) is kept in an ultrasonic transducer for producing periodic mechanical strain onto the piezoelectric $NaNbO_3$ working electrode. A tungsten halogen lamp is used as a light source for illumination.

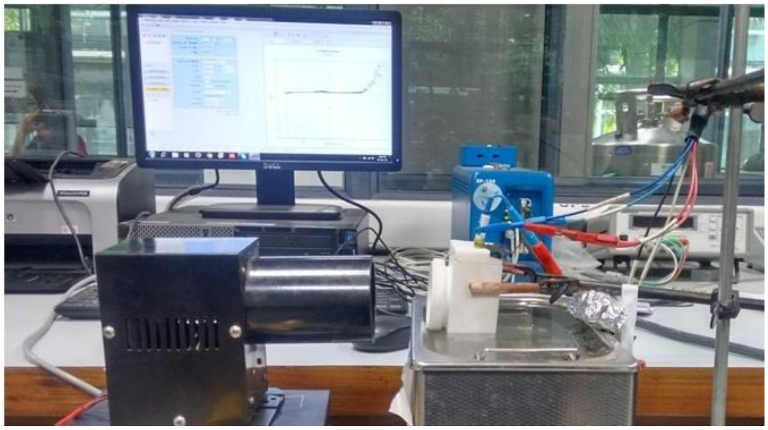

**Fig. S4.** Experimental setup used for studying piezo-photoelectrochemical activity.