Electronic Supplementary Material (ESI) for RSC Advances
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Electronic Supplementary Information (ESI)

Revisiting $SrTiO_3$ as a photoanode for water splitting: Development of thin films with enhanced charge separation under standard solar irradiation

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The overpotential is defined as the potential difference (voltage) between a half-reactions reduction potential (thermodynamically determined) and the potential (redox event) experimentally observed [1].

However, in the water photoelectrolysis, the onset voltage for photocurrent (V_{on}) under standard illumination condition is bellowing the 1.23 V_{RHE}. Thus we can define a pseudo-overpotential as the difference between the onset voltage for photocurrent (V_{on}) under standard illumination condition and the flat band potential (V_{fb}), i.e. $\eta_{OX} = V_{on} - V_{fb}$. This definition is valid when the h^+ diffusion length (L_P) is much shorter than the depletion layer width (W_{SC}) ($Lp << W_{SC}$), and hence the photocurrent is primarily due to the carriers generated in the depletion layer.

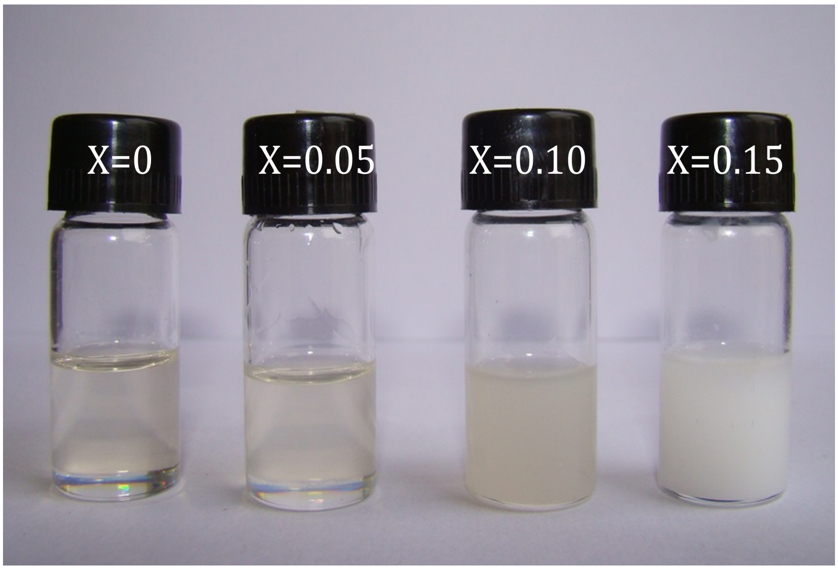

Figure S1 - Photograph of vials containing colloidal dispersion of $SrTiO_3$ nanoparticles doped with different Nb concentration. We can observe that the colloidal stability decrease with the increase of Nb .

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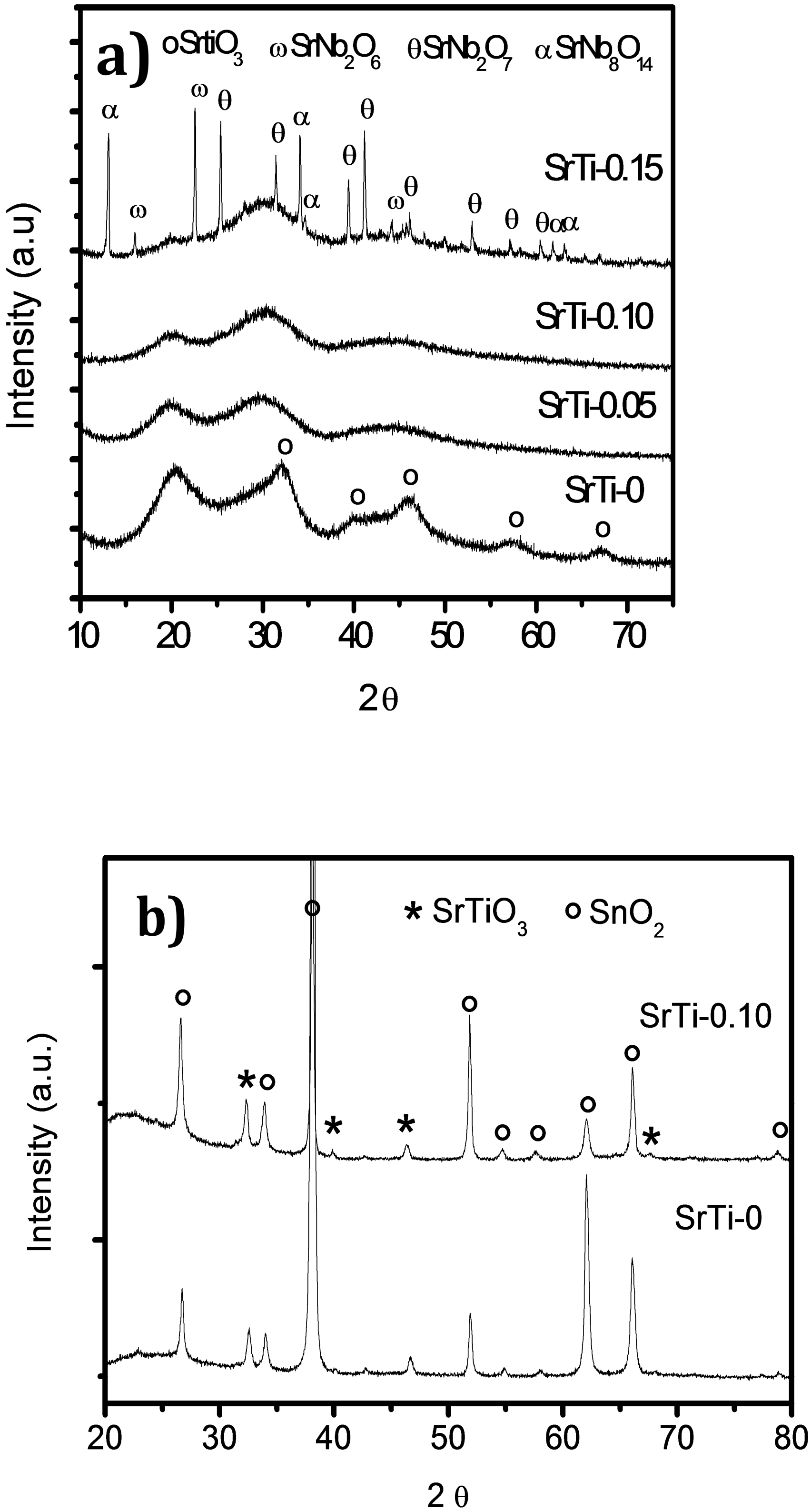

Figure S2 –a) XRD analysis of the as prepared $SrTiO_3$ nanoparticles doped with different Nb concentration; b) XRD analysis of the Nb-doped and undoped $SrTiO_3$ thin film (after sintering process).

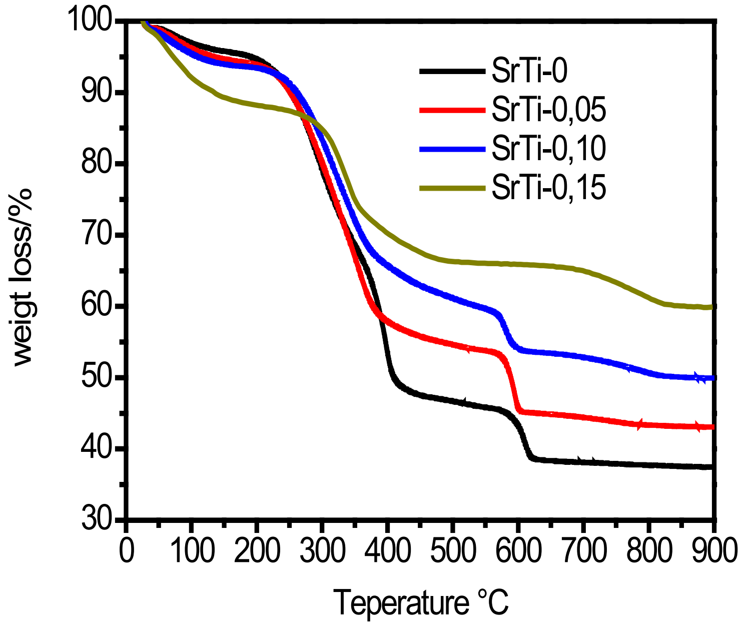

Figure S3 – Thermogravimetric analysis of the as prepared $SrTiO_3$ nanoparticles doped with different Nb concentration. Heating rate of 10^{o}C/min.; atmosphere-O_2 flow.

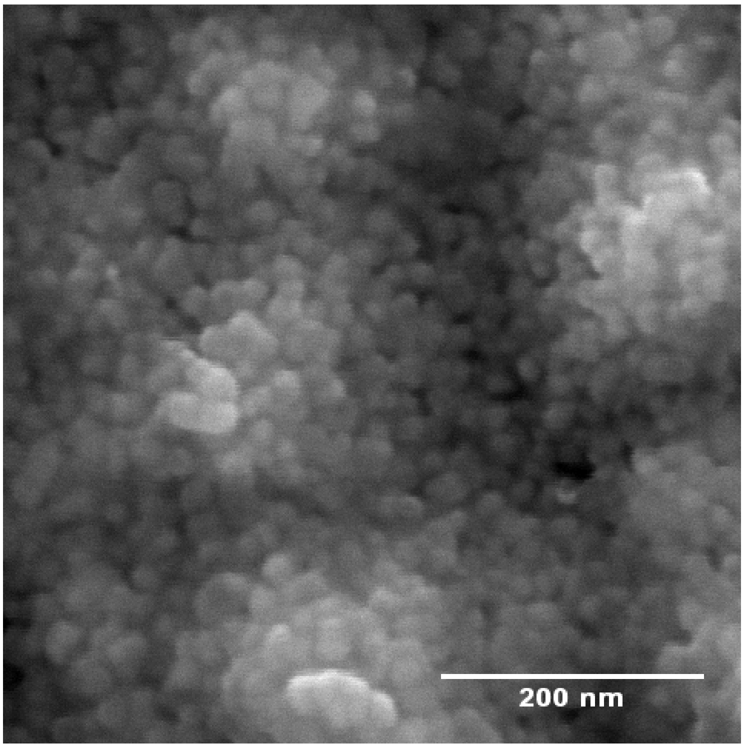

Figure S4 – High magnification in-lens secondary electron image of the STO sample

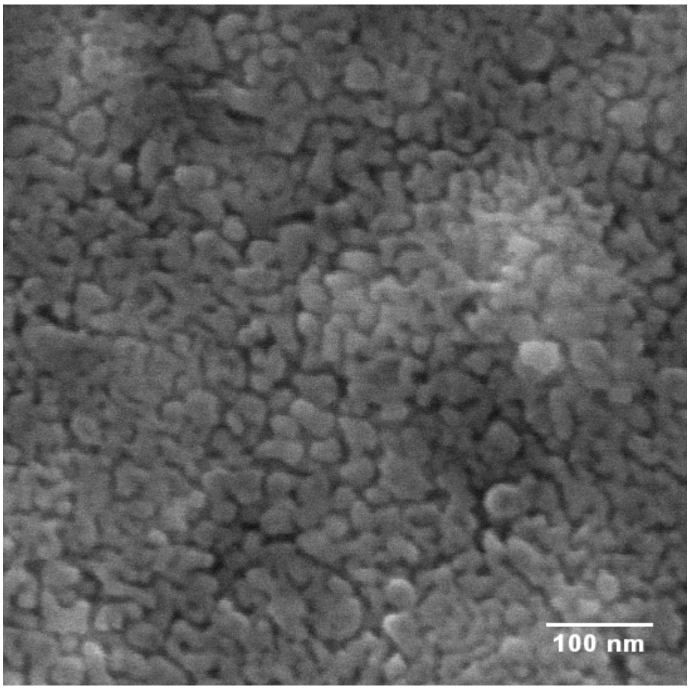

Figure S5 – High magnification in-lens secondary electron image of the Nb-STO sample

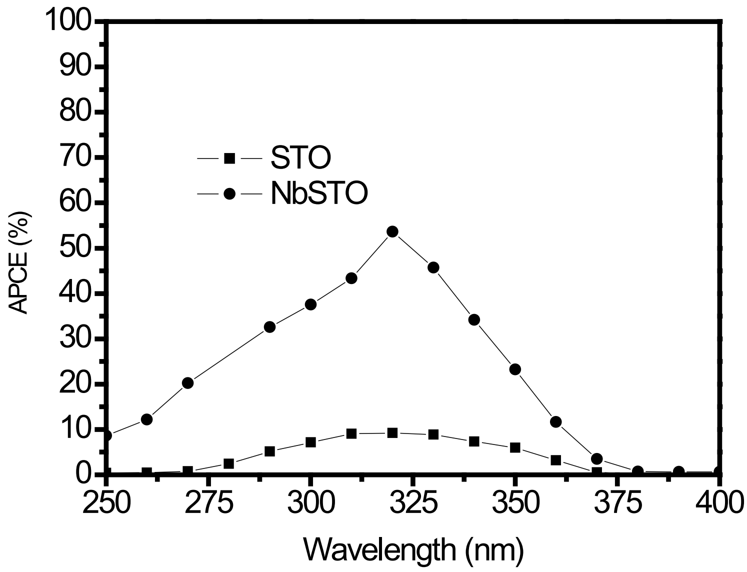

Figure S6 – APCE measurement of the Nb-STO and STO photoanodes under front illumination.

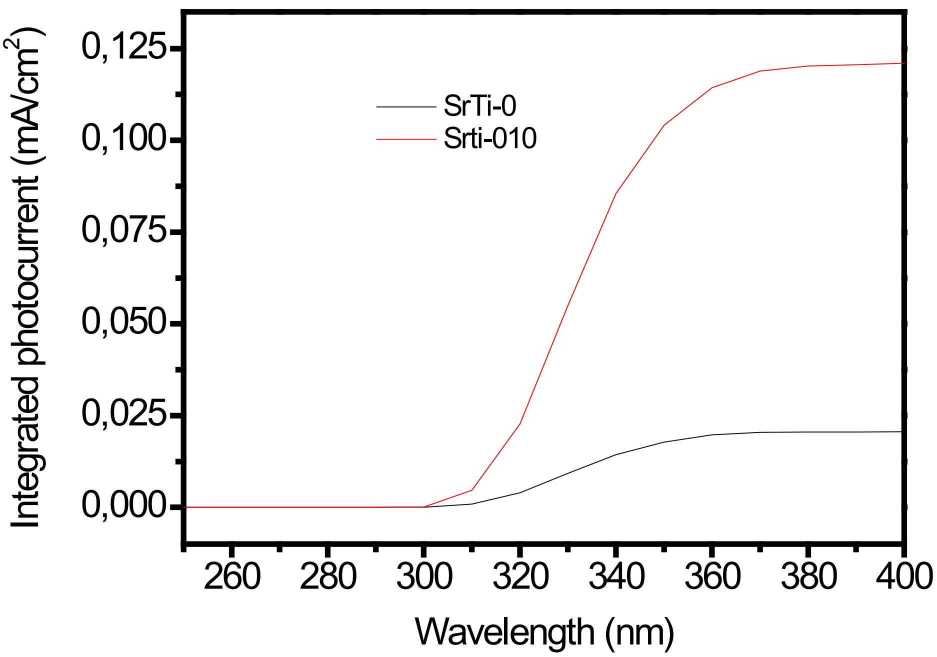

Figure S7 – Integrated solar photocurrent for IPCE data with the standard solar spectrum (AM 1.5/100 mW.cm−2), for the samples STO and Nb-STO.

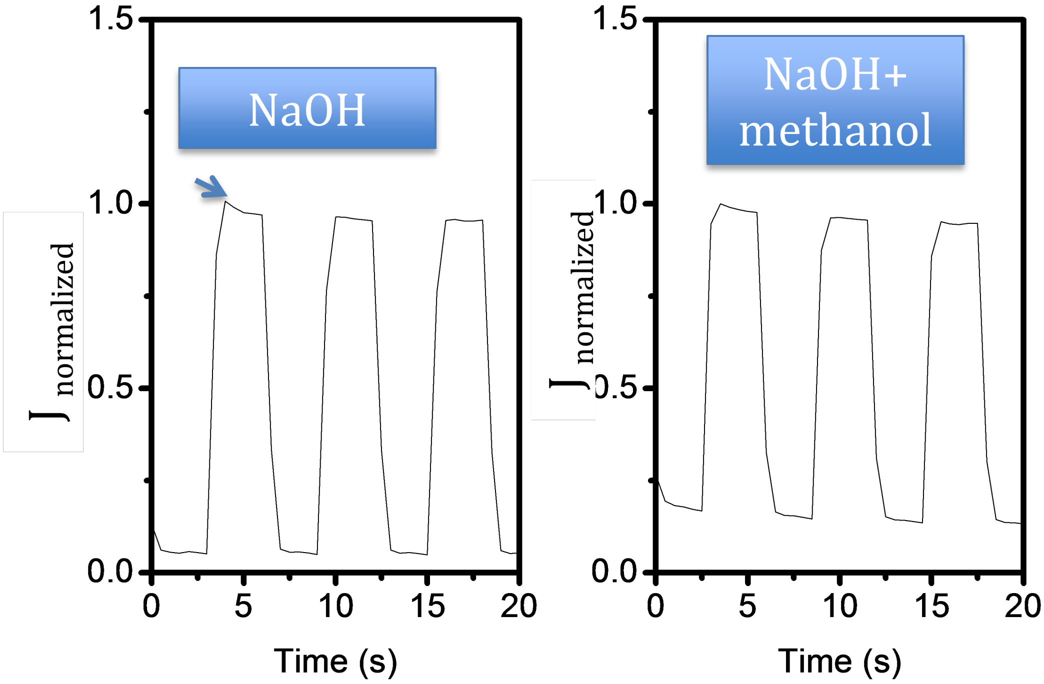

Figure S8 – Normalized Photocurrent (J/J_{Max}) transient measurements performed at 0.3 V_{RHE}, under standard solar illumination. The arrow indicate the spike.

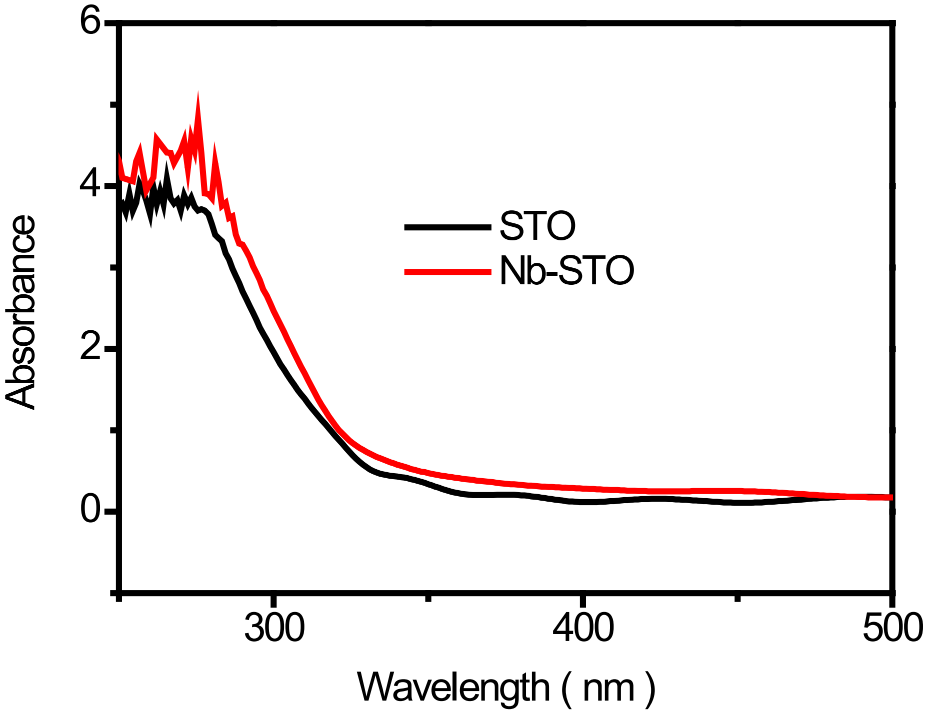

Figure S9 – UV-Vis absorption spectroscopy measurement for the STO and Nb-STO samples.

References

[1] - Bard, A.J.; Faulkner, L.R. Electrochemical Methods: Fundamentals and Applications. New York: John Wiley & Sons, 2nd Edition, 2000.