Supporting Information for:

Surfactant free pH assisted facile engineering of hierarchical rutile TiO₂ nanostructures by single step hydrothermal method for water splitting

application

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> Detailed calculation of theoreticle pH

In aqueous solution strong acid HCl fully dissociate to H⁺ and Cl⁻ ions.

pH of the strong acid can be calculated as,

 $pH = -\log (f x [H^+])$

Where,

f = activity coefficient

 $[H^+]$ = concentration of H⁺ ions

For HCl $[H^+] = [HCl]$ Where, [HCl] =concentration of HCl

For example, In case of H6 sample, [HCl] = 3.4 M Hence,

$$[H^+] = 3.4 M$$

:: $pH = -\log (f x [H^+])$

For HCl f = 1 $\therefore pH = -\log ([H^+])$ $= -\log (3.4)$ $\therefore pH = -0.53$

> Figures



Figure S1: XRD patterns of all samples with y-offset (for comparison of peak intensity)



Figure S2: The $(ahv)^{\frac{1}{2}}$ versus hv plots of TiO₂ thin films.



Figure S3: Cross section SEM images of all samples



Figure S4: SEM image of fractured microshpere of H6 sample



Figure S5a The TEM images describing calculation of interplaner distance of planes from far lateral side of TiO₂ nanorod using GATAN Digital Micrograph software.



Figure S5b The TEM images describing calculation of interplaner distance of planes from lateral side of TiO₂ nanorod using GATAN Digital Micrograph software.



Figure S5c The TEM images describing calculation of interplaner distance of planes from top side of TiO₂ nanorod using GATAN Digital Micrograph software.