Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supporting information to

Enhanced photocatalytic hydrogen production from Y_2O_3/TiO_2 nano-composites: A comparative study on hydrothermal synthesis with and without ionic liquid

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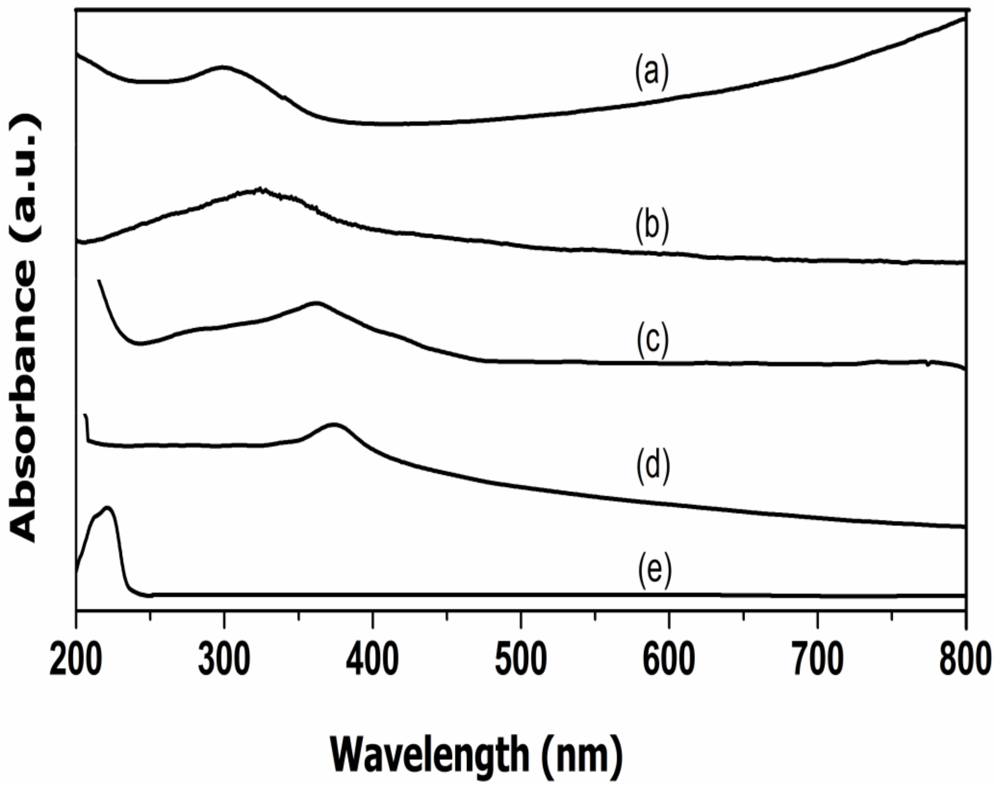


Fig.S1 UV-Vis spectra of (a) pristine $TiO_{2(ILAHM)}$ NPs, (b) 25 wt%, (c) 50 wt% , (d) 75 wt% Y_2O_3/ TiO_2 NCs $_{(ILAHM)}$ and (e) pristine $Y_2O_{3\,(ILAHM)}$ NPs.

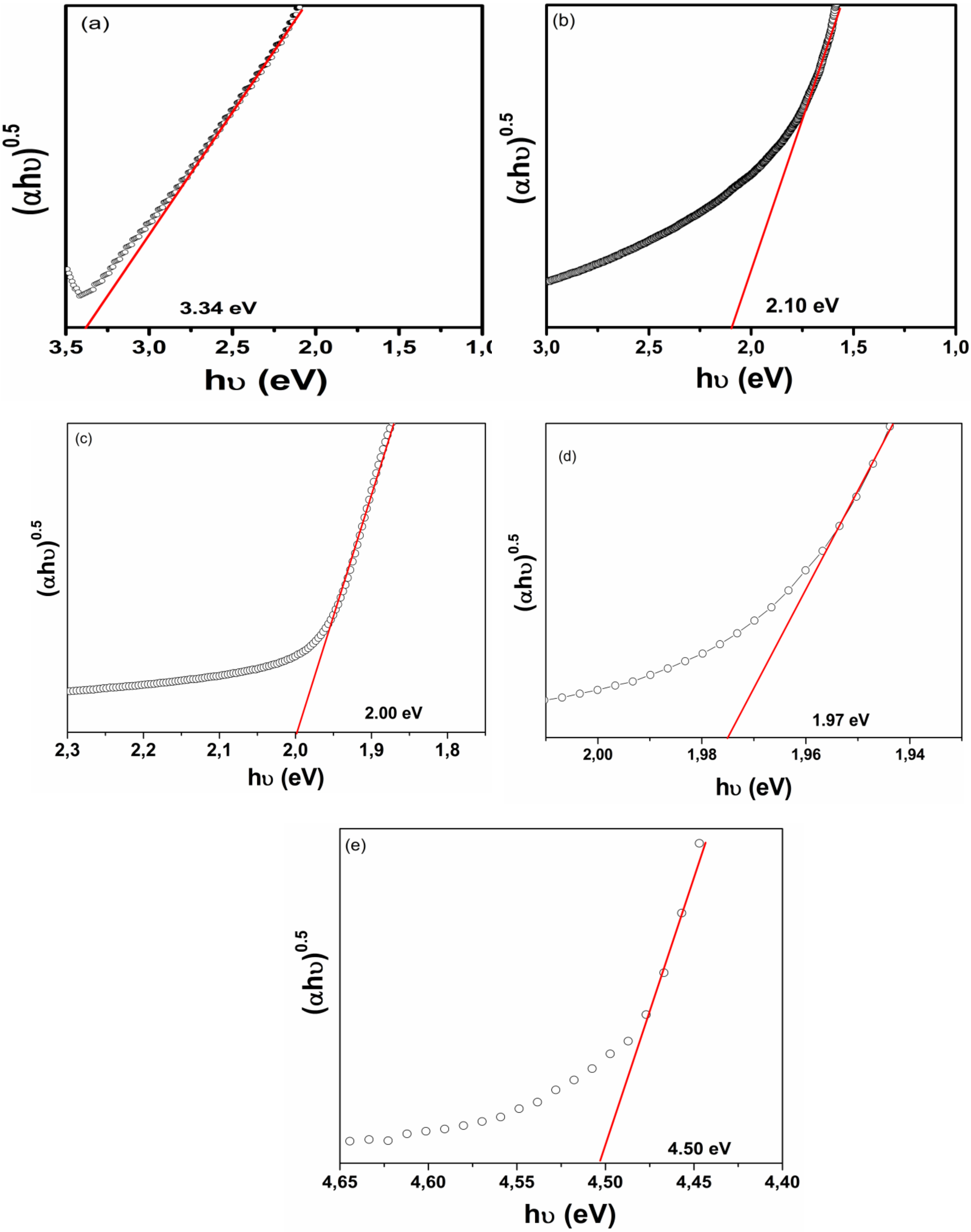


Fig. S2 Tauc Plot functions for the determination of band gaps of (a) pristine $TiO_{2(ILAHM)}$ NPs, (b) 25 wt%, (c) 50 wt% , (d) 75 wt% Y_2O_3/ TiO_2 NCs $_{(ILAHM)}$ and (e) pristine Y_2O_3 $_{(ILAHM)}$ NPs.

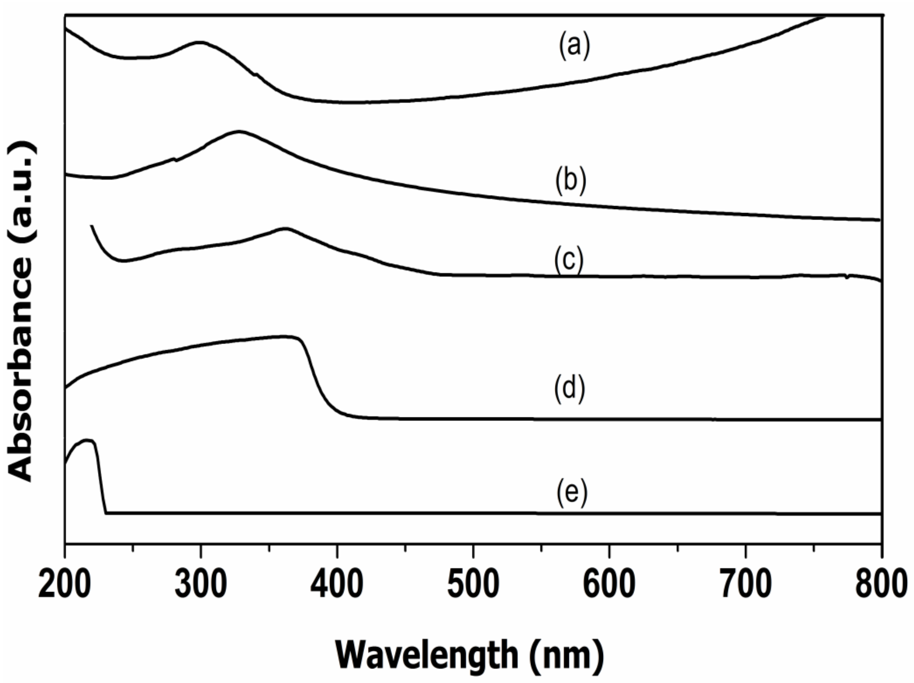


Fig. S3 UV-Vis spectra of (a) pristine $TiO_{2(HM)}$ NPs, (b) 25 wt%, (c) 50 wt% , (d) 75 wt% Y_2O_3/ TiO_2 NCs $_{(HM)}$ and (e) pristine $Y_2O_{3\,(HM)}$ NPs.

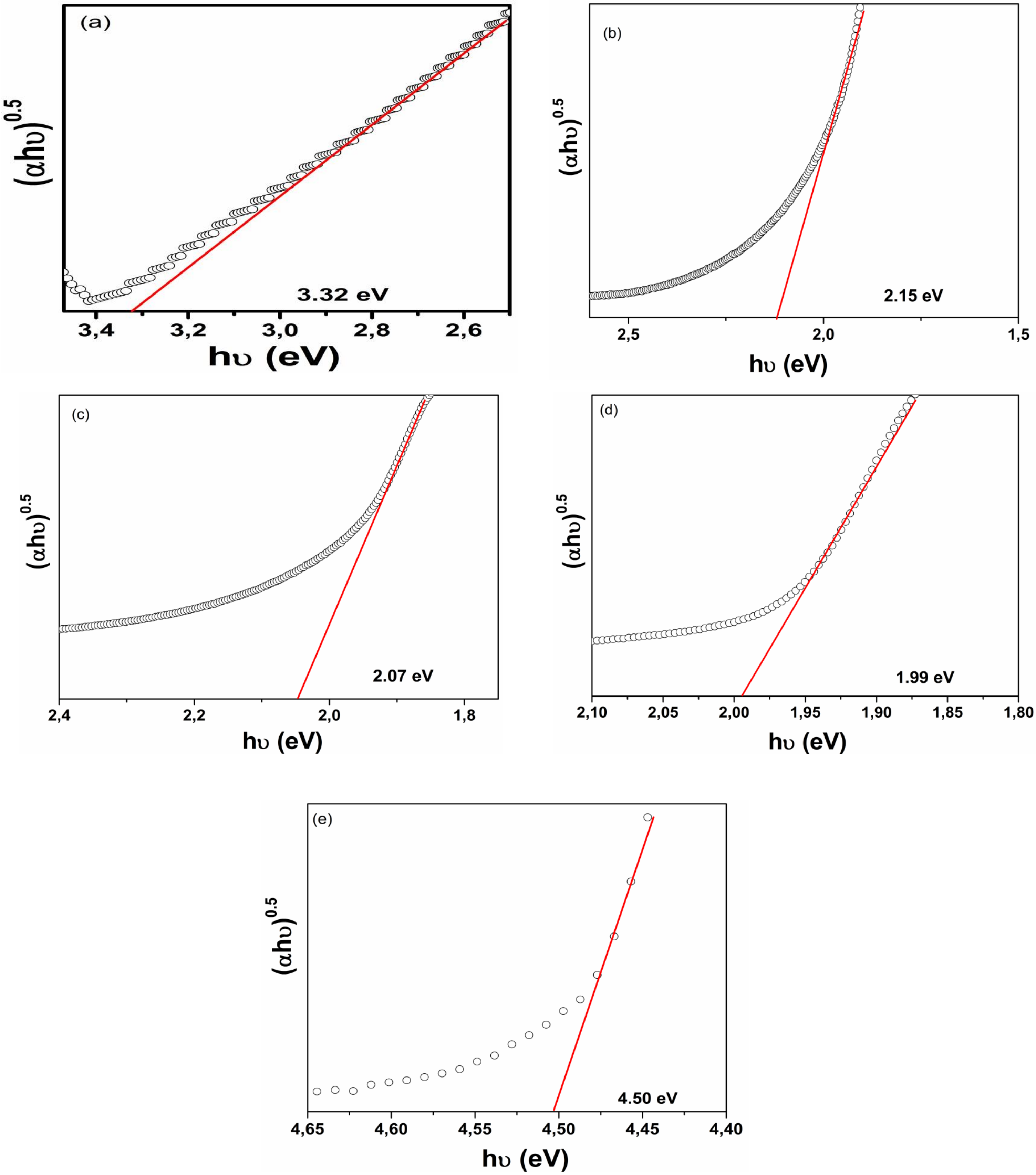


Fig. S4 Tauc Plot functions for the determination of band gaps of (a) pristine $TiO_{2(HM)}$ NPs, (b) 25 wt%, (c) 50 wt% , (d) 75 wt% Y_2O_3/ TiO_2 NCs $_{(HM)}$ and (e) pristine Y_2O_3 $_{(HM)}$ NPs.

Table S1 Crystallite size and BET surface area of the 25 wt % Y_2O_3/ TiO_2 NC at different temperatures (500 – 800 °C for 1h), synthesized via ILAHM and HM.

Temperature (°C)	**Crystalline size (nm)**		**BET surface area (m^2/g)**	
	ILAHM	**HM**	**ILAHM**	**HM**
500	39.5 for (101)	…..	46.7	37.3
600	37.5 for (101)	-------	41.3	34.1.
700	26.5 for (101)	--------	36.7	32.7
800	-------	-------	31.5	31.1

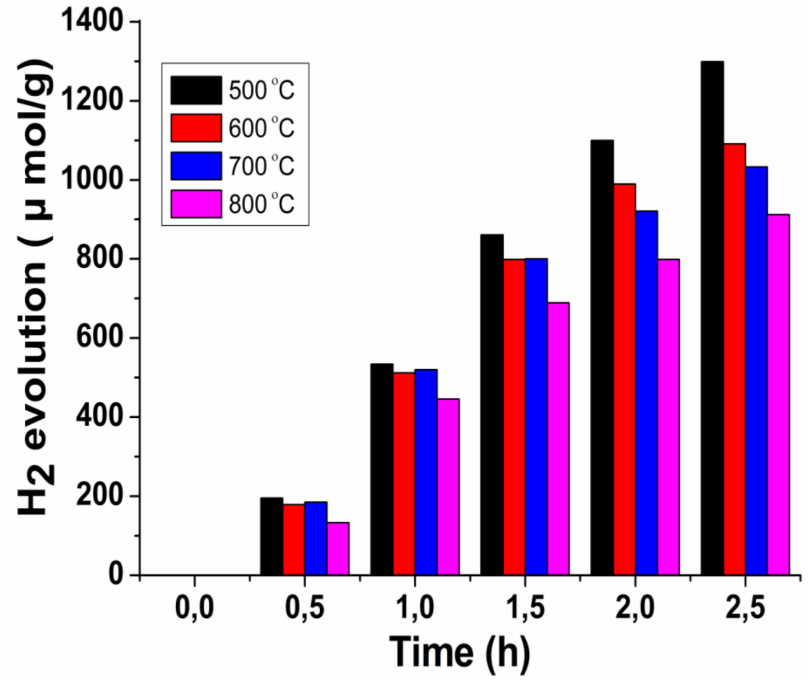


Fig.S5 Hydrogen generation of 25 wt% Y_2O_3/ TiO_2 NC $_{(ILAHM)}$, calcinated at different temperatures (500 – 800 °C for 1h).

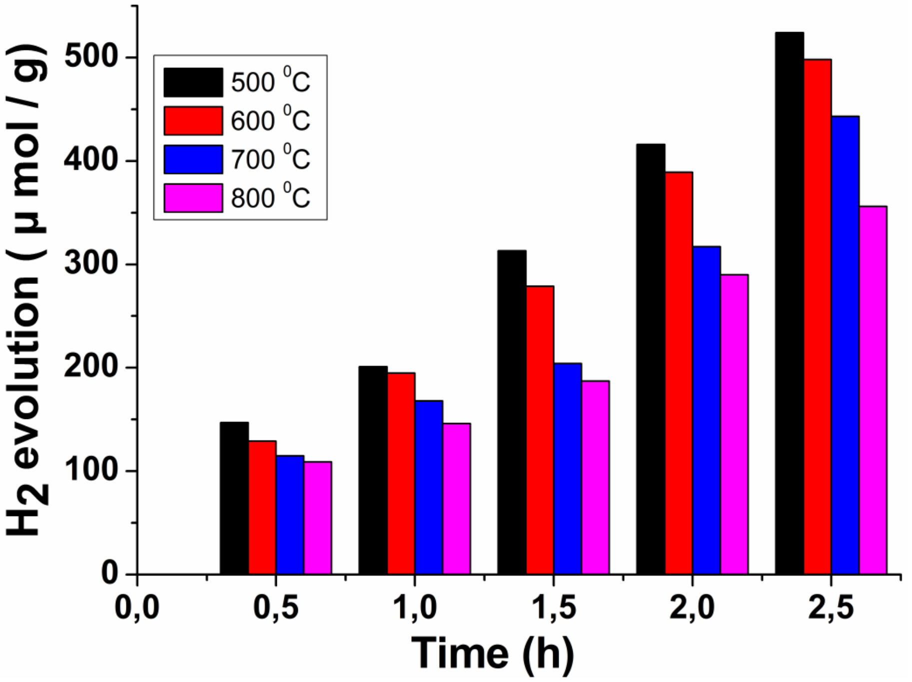


Fig. S6 Hydrogen generation of 25 wt% Y_2O_3/ TiO_2 NC $_{(HM)}$, calcinated at different temperatures (400 to 800 °C for 1 h).

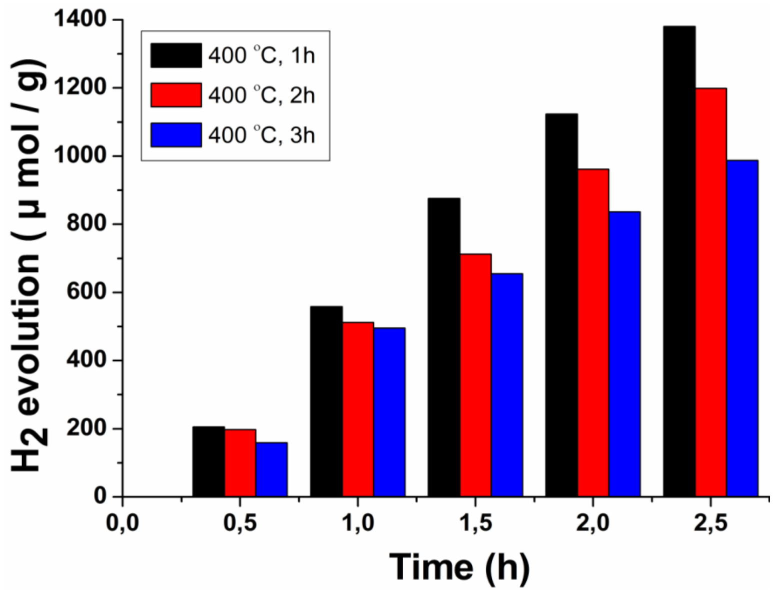


Fig. S7 Hydrogen generation of 25 wt% Y_2O_3/ TiO_2 $NC_{(ILAHM)}$, calcinated at 400 °C for 1, 2 and 3 hours.

Step 1: $TiCl_4 + Y(NO_3)_3 + H_2O + NaOH \longrightarrow \{_3(HO)Ti/Y(HO)_2\} + NaNO_3 + NaCl$

Step 2: $\{_3(HO)Ti/Y(HO)_2\} \xrightarrow{\Delta} Y_2O_3/TiO_2$ Nano- composite

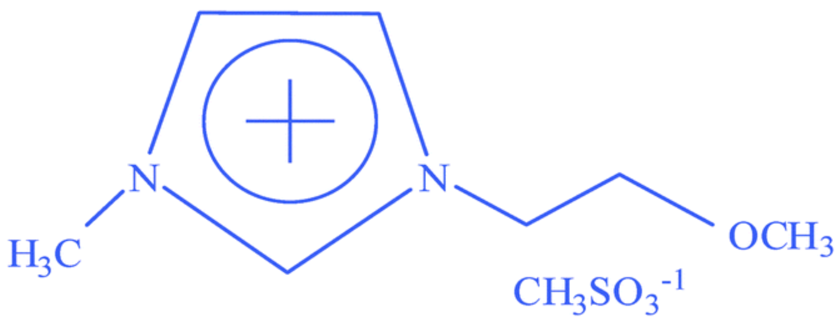
Scheme. S1(a). Proposed mechanism for the formation of Y_2O_3/ TiO_2 NC in the absence of IL.

Step 1: $TiCl_4 + Y(NO_3)_3 +$ MOEMI. $CH_3SO_3^{-1} \xrightarrow[NaOH]{H_2O}$ {MOEMI. CH_3SO_3 . $_3(HO)$ Ti-Y $(HO)_2\} + NaNO_3 + NaCl$

Step 2: {MOEMI. CH_3SO_3 . $_3(HO)$ Ti-Y $(HO)_2\} \xrightarrow{\Delta} Y_2O_3/TiO_2$ Nano- composite + MOEMI. $CH_3SO_3^{-1}$ + H_2O

Scheme S1 (b). Proposed mechanism for the formation of Y_2O_3/ TiO_2 NC in the presence of IL*

* MOEMI.$CH_3SO_3^{-1}$ = 1-(2-methoxyethyl)-3-methylimidazolium methanesulfonate



Scheme S2. Structure of 1-(2-methoxyethyl)-3-methylimidazolium methanesulfonate.

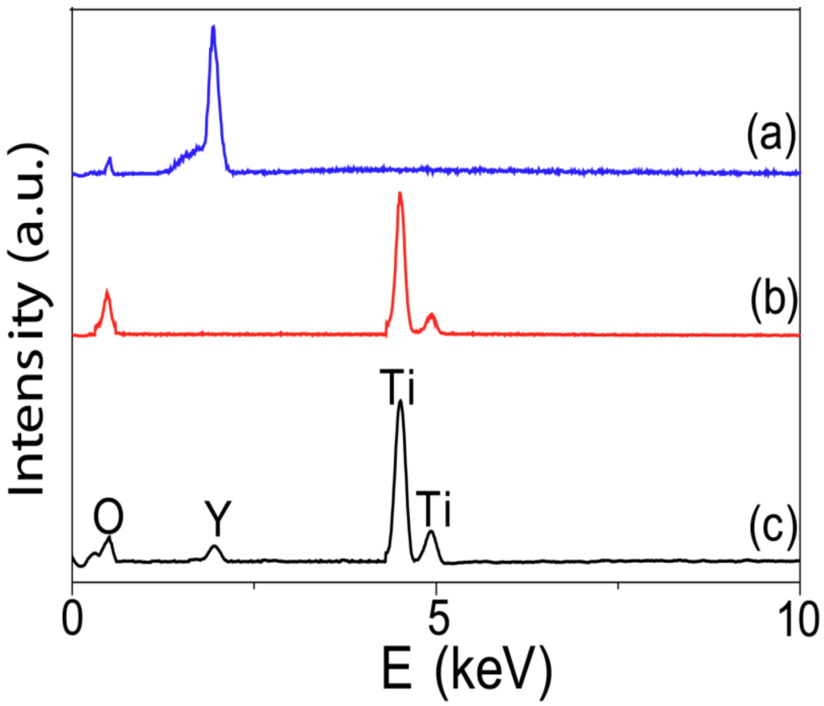


Fig. S8 EDS spectra of (a) pristine Y_2O_3 NPs (b) pristine TiO_2 NPs and (c) 25 wt% Y_2O_3/ TiO_2 $NC_{(ILAHM)}$.

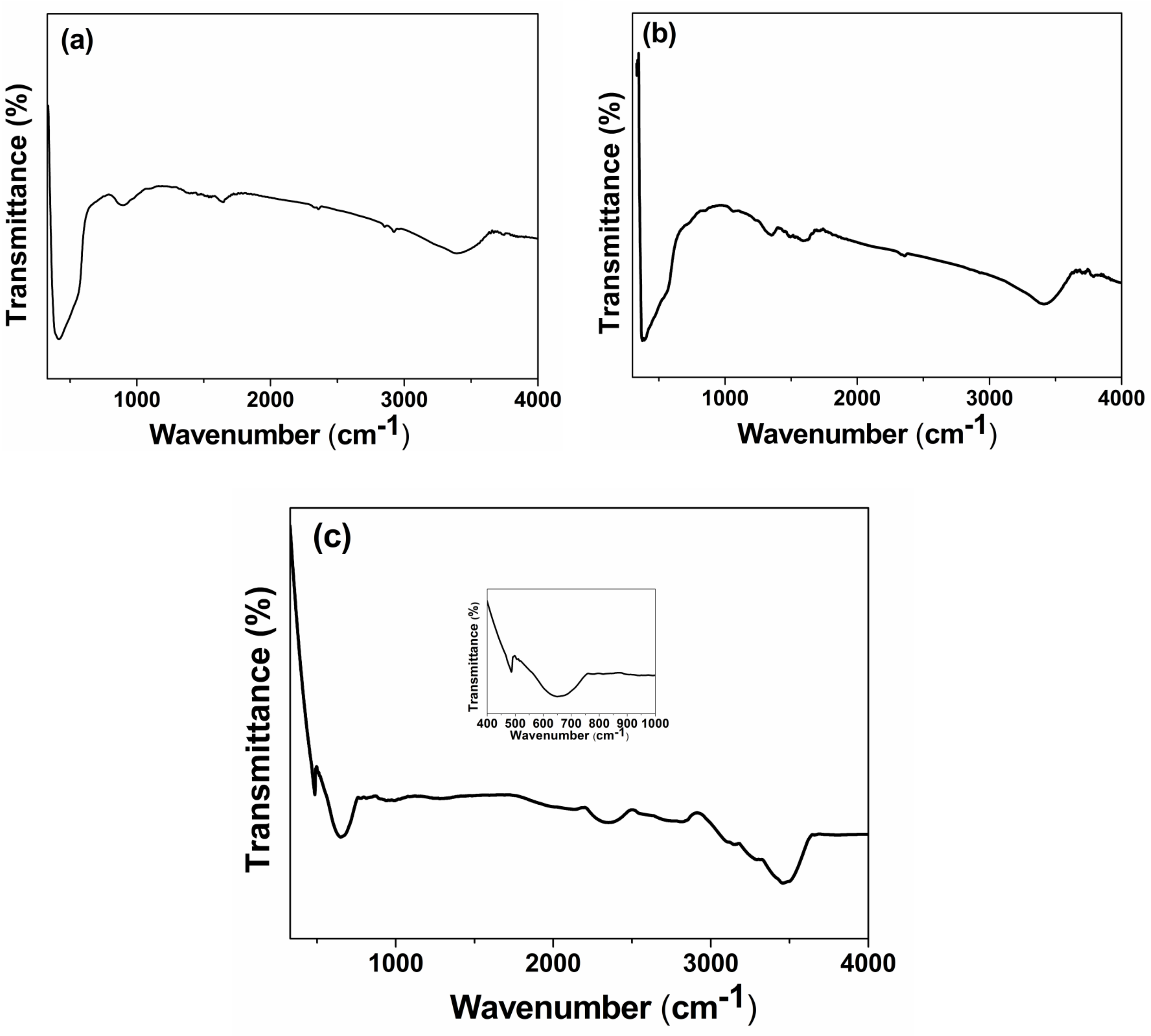


Fig. S9 FT-IR spectra of (a) pristine Y_2O_3 NPs (b) pristine TiO_2 NPs and (c) 25 wt% Y_2O_3/TiO_2 NC $_{(ILAHM)}$, (inserted in Fig. (c) Showed the zoom-in view of the FT-IR spectra in the range of interest, e.g 400-1000 cm^{-1} of Y_2O_3/TiO_2 NC $_{(ILAHM)}$.