

Supporting information

Nitrogen-Doped Anatase Nanofibers Decorated with Noble Metal Nanoparticles for Photocatalytic Production of Hydrogen

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1. Photos of original TiO₂ NFs and two different N-doped TiO₂ NFs powders

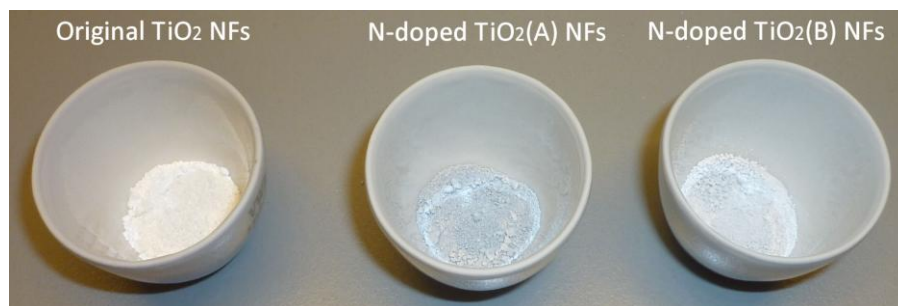


Figure S1. Photo shows the original TiO₂ NFs and two different N-doped TiO₂ NFs powders (for description of the materials see the main text).

2. X-ray diffraction patterns of N-TiO₂ nanofibers decorated with noble metal nanoparticles

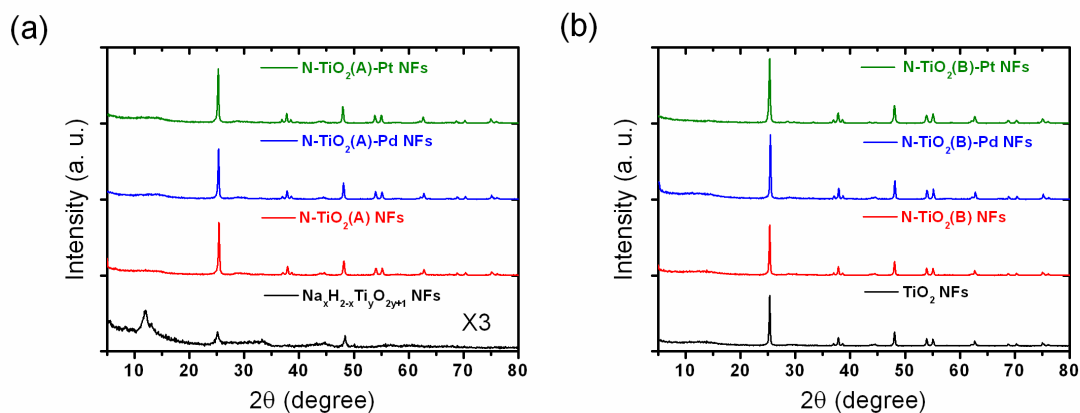


Figure S2. XRD patterns of the nanofibers catalysts. (a) H_{2-x}Na_xTi_yO_{2y+1} NF, N-TiO₂(A) NF, and noble metal decorated N-TiO₂(A) NF catalysts; (b) TiO₂ NF, N-TiO₂(B) NF, and noble metal decorated N-TiO₂(B) NF catalysts.

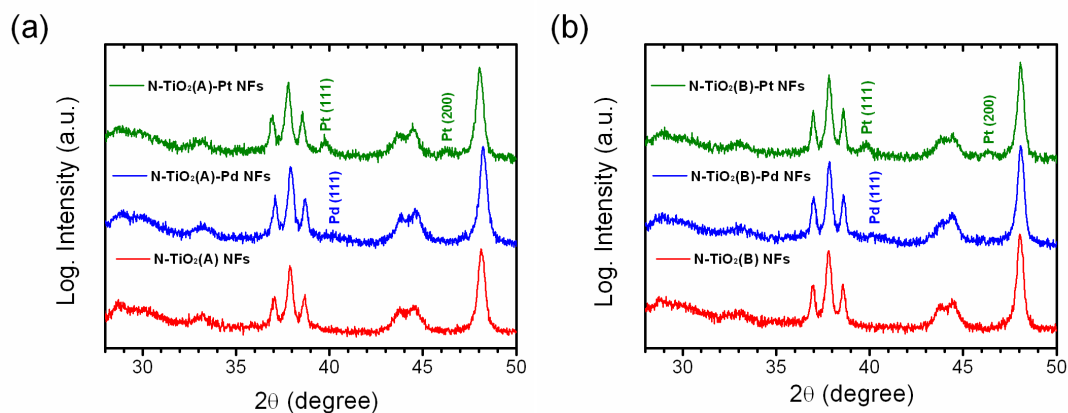


Figure S3. XRD patterns of N-doped TiO₂ nanofibers with and without noble metal decoration. (a) N-TiO₂(A) NF and N-TiO₂(A) NF decorated either with Pt or Pd; (b) N-TiO₂(B) NF and N-TiO₂(B) NF decorated either with Pt or Pd.

3. Absorption spectra of the different TiO₂ nanomaterials

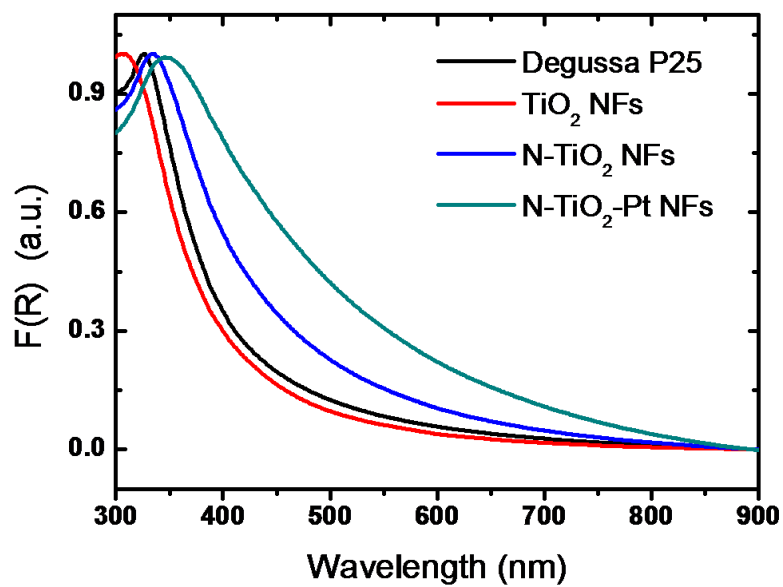


Figure S4. Normalized absorption spectra of the TiO₂ based materials used in the photocatalytic experiments.

4. Turnover frequency of the four different types of catalyst

	N-TiO ₂ (A)-Pd	N-TiO ₂ (A)-Pt	N-TiO ₂ (B)-Pd	N-TiO ₂ (B)-Pt
UV-A	0.039 1/s	0.021 1/s	0.037 1/s	0.061 1/s
UV-B	0.160 1/s	0.100 1/s	0.226 1/s	0.197 1/s

5. Summary of hydrogen production rates over metal decorated TiO₂ based photocatalyst materials with corresponding references

Table S1 Summary of hydrogen production characteristics of anatase TiO₂ photocatalysts decorated with noble metals

Group (Year)	Catalyst (metal load)	Catalyst mass (mg)	Illumination condition	Reactants	TiO ₂ synthesis method	Metal decoration method	H ₂ rate normalized to catalyst mass ($\mu\text{mol/g}\cdot\text{h}$)	Ref.#
Yang <i>et al.</i> (2006)	Pt-TiO ₂ (1.0 wt%)	500	100 W UV Hg lamp	~ 400mL ethanol	Sol-gel	Impregnation	3,000	35
Yang <i>et al.</i> (2006)	Pd-TiO ₂ (1.0 wt%)	500	100 W UV Hg lamp	~ 400mL ethanol	Sol-gel	Impregnation	3,300	35
Sreethawong <i>et al.</i> (2007)	Pt-TiO ₂ (0.6 wt%)	200	300 W Hg lamp	200 mL water + 20 mL methanol	Sol-gel	Single-step sol-gel process	6,900	36
Sreethawong <i>et al.</i> (2007)	Pt-TiO ₂ (0.6 wt%)	200	300 W Hg lamp	200 mL water + 20 mL ethanol	Sol-gel	Single-step sol-gel process	5,600	36
Zou <i>et al.</i> (2007)	Pt-TiO ₂ (1.0 wt%)	500	300 W Hg lamp	200 mL water + 150 mL ethanol	Sol-gel	Impregnation	6,900	37
Zou <i>et al.</i> (2007)	Pt-TiO ₂ (0.5 wt%)	500	300 W Hg lamp	200 mL water + 50 mL ethanol	Sol-gel	Plasma	8,600	37
Sun <i>et al.</i> (2008)	Pt-TiO ₂ (0.5 wt%)	200	500 W Hg lamp	100 mL water + 20 mL ethanol	Sol-gel	Photochemical deposition	8,100	38
Rosseler <i>et al.</i> (2010)	Pt-TiO ₂ (0.3 wt%)	1000	150 W metal halide lamp	250 mL methanol + 750 mL water	Sol-gel	Impregnation	1,920	39
Rosseler <i>et al.</i> (2010)	Au-TiO ₂ (2.0 wt%)	1000	150 W metal halide lamp	10mL methanol + 990mL water	Sol-gel	Impregnation	7,200	39
Zhang <i>et al.</i> (2010)	Pt-TiO ₂ (0.5 wt%)	100	300 W Hg lamp	54 mL methanol + 216 mL water	Nanocasting	Photodeposition	2,200	40
Our Group (2010) (2011)	TiO ₂ NF	200	6x15 W UV-B lamps; Calculated UV power on reactor ~1.46 W	Mixture of 500 mL (95 vol.%) ethanol and 500 mL water	Hydrothermal synthesis of titanate followed by various calcination processes using air and/or ammonia	No catalyst metal is applied	150	25
	N-TiO ₂ (A) NF	100					1,200	this work
	N-TiO ₂ (B) NF	100					300	this work
	Pt-TiO ₂ NP (1.0 wt%)	200				Wet impregnation followed by decomposition of the metal precursor in air and finally reduction in H ₂ flow	3,750	25
	Pt-TiO ₂ NF (1.0 wt%)	200					2,250	25
	N-TiO ₂ (A)-Pt NF (1.0 wt%)	100					15,500	this work
	N-TiO ₂ (B)-Pt NF (1.0 wt%)	100					22,500	this work