Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

Appendix A: Supporting information (SI):

The promoted effect of visible light on the CO + NO reaction over Pd/N-TiO$_2$ catalyst

Xiaofang Tan[a,b], *Gang Cheng*[a,b], *Xinjie Song*[a,b], *Xun Chen*[a], *Wenxin Dai*[a,b]*, *Xianzhi Fu*[a]*

[a] Research Institute of Photocatalysis, State Key Laboratory of Photocatalysis on Energy and Environment, Fuzhou University, Fuzhou, 350002, China

[b] Key Laboratory of Eco-materials Advanced Technology (Fuzhou University), Fujian Province University, Fuzhou, 350002, China

*Corresponding author: Wenxin Dai & Xianzhi Fu

Tel & Fax: +86-591-22865893

E-mail: daiwenxin@fzu.edu.cn & xzfu@fzu.edu.cn

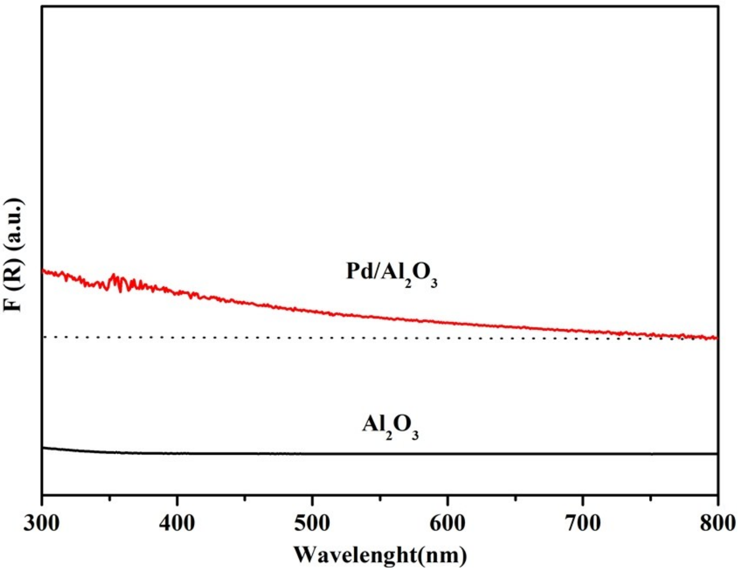


Fig. S1. The UV-vis diffused reflectance spectra of Al_2O_3 and Pd/Al_2O_3 samples.

To further verify Pd-supported introducing the absorption of visible light, Pd nanoparticles were loaded onto light-insensitive of Al_2O_3. The adsorption edge of Pd/Al_2O_3 showed an obvious absorption edge from wavelength 400 to 800 nm, the absorption edge ended at 800 nm. It further tested that Pd-supported could enhanced the absorption of visible light.

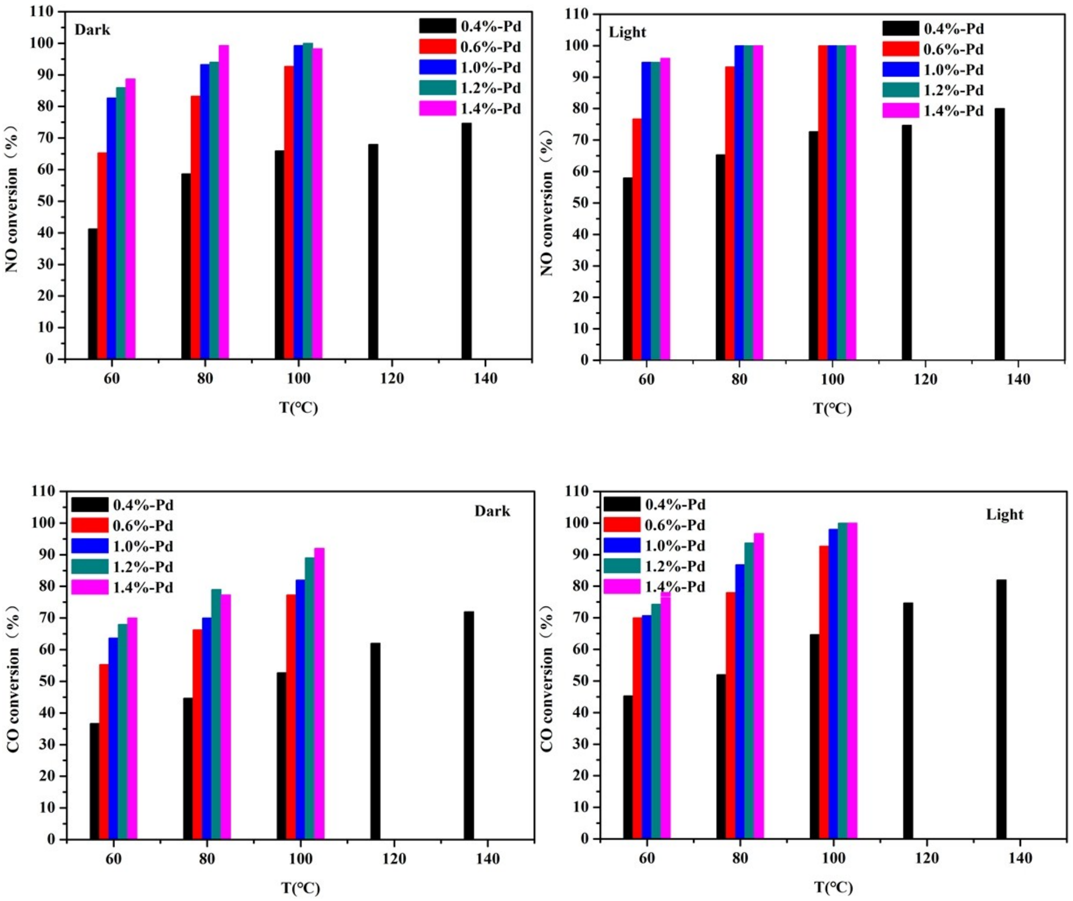


Fig. S2. NO conversion and CO conversion at different temperatures over Pd/N-TiO_2 sample with different Pd content under visible light irradiation or not.

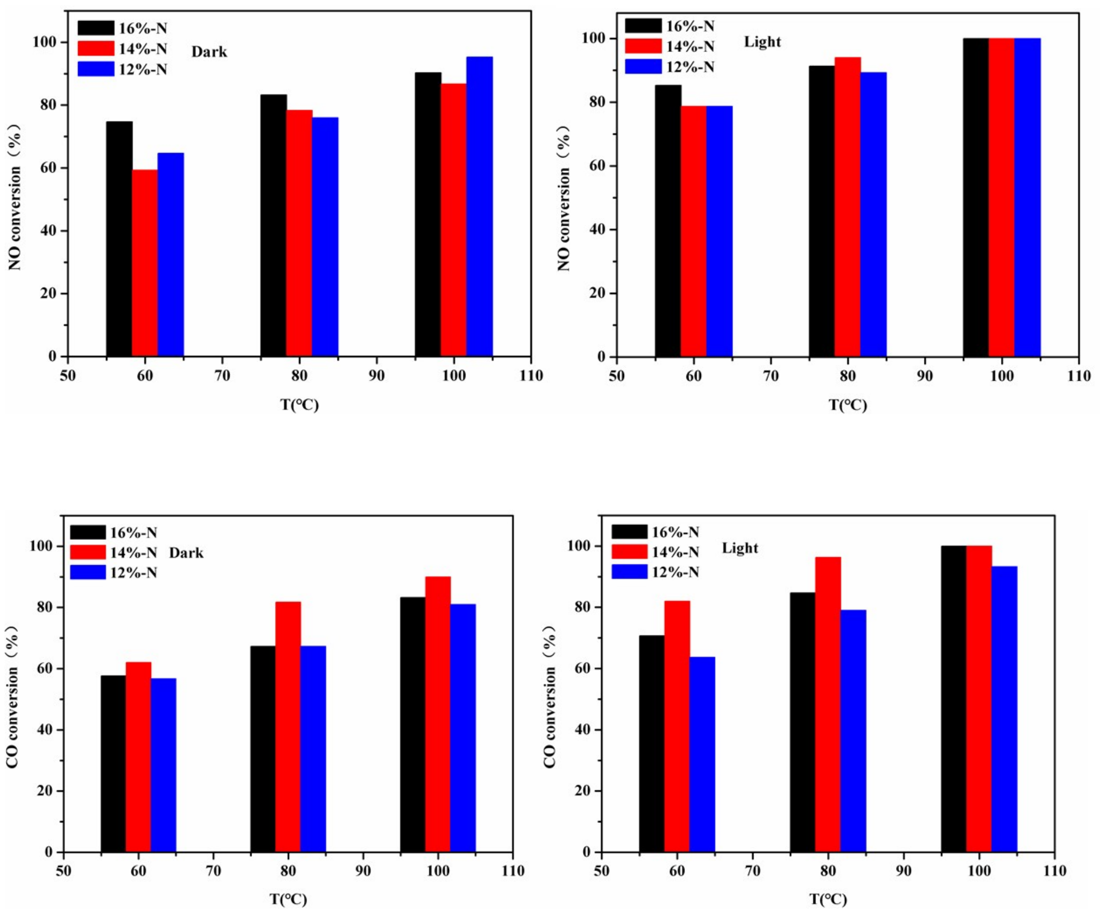


Fig. S3. NO conversion and CO conversion at different temperatures over Pd/N-TiO_2 sample with different N content under visible light irradiation or not.

Table S1: The High-resolution XPS spectra area of O 1s of Pd/N-TiO_2 sample under different conditions.

	Fresh sample (Area (P) CPS.eV)	Reacted in dark (Area (P) CPS.eV)	Reacted under visible light irradiation (Area (P) CPS.eV)
$O_{(L)}$	7497.48	7049.19	6719.38
$O_{(ad)}$	1074.31	1122.81	1487.84

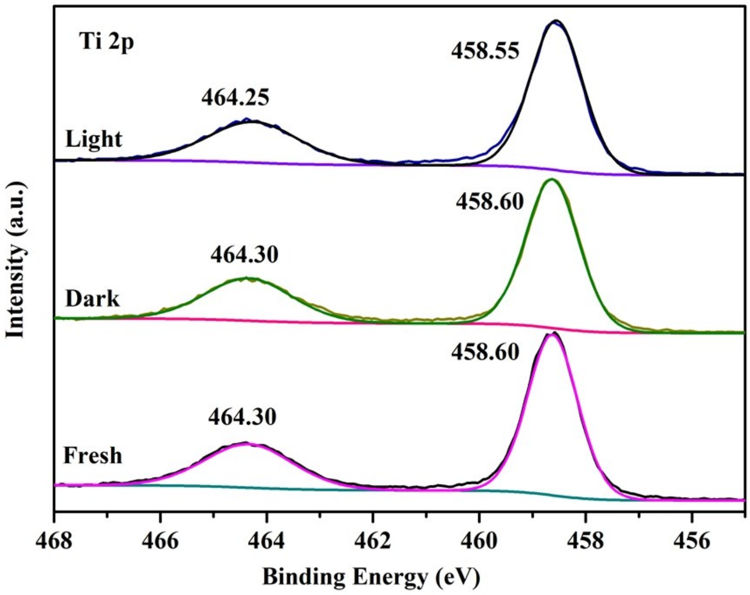


Fig. S4. High-resolution XPS spectra of Ti 3d of Pd/N-TiO_2 sample under different treatment: the fresh sample, reacted in dark, and reacted under visible light irradiation.

As shown in SI. 4, a High-resolution XPS spectra of Ti 3d of Pd/N-TiO_2 sample under different treatment: the fresh sample, reacted in dark, and reacted under visible light irradiation. After reacted in dark, the BE values of Ti 3d did not change, while the introduce of visible light made a slight shift to lower BE values.

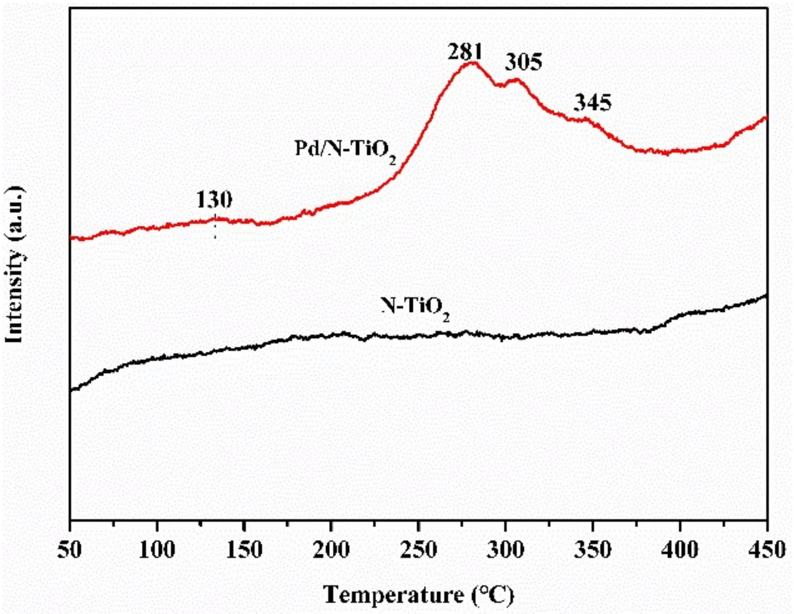


Fig. S5. H_2-TPR spectra of N-TiO_2 and Pd/N-TiO_2 samples after heating in He at 300 ^oC for 1h.

As seen in Fig. S5, the peak at 130 ^oC, assigned to the reduction of oxidized palladium species, was very weak, indicating that palladium species in Pd/N-TiO_2 sample were mainly existed in the state of Pd^0. As for the peaks at 281, 305 and 345 ^oC in Fig. R1, they could be attributed to reduced signals of N-TiO_2induced by hydrogen dissociation on metal easily diffused to the support (*ACS Catal.* 2013, 3, 2327-2335).

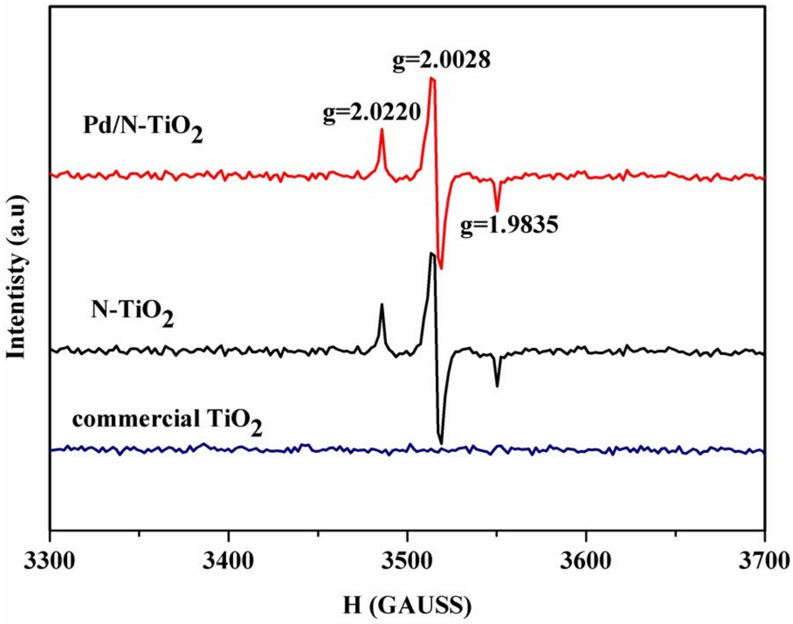
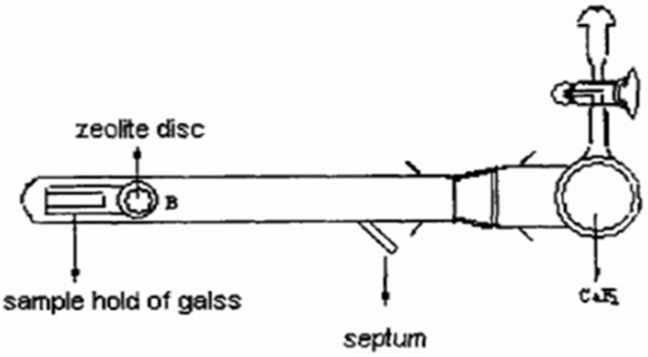


Fig. S6. The EPR spectra of commercial TiO_2, N-TiO_2 and Pd/N-TiO_2 samples.

As showed in SI. 6, no signal peaks were detected for TiO_2 sample under light visible or not, while three signal peaks for N-TiO_2 and Pd/N-TiO_2 samples was observed, indicated that the emergence of these peaks induced by N-doped.



In situ IR cell

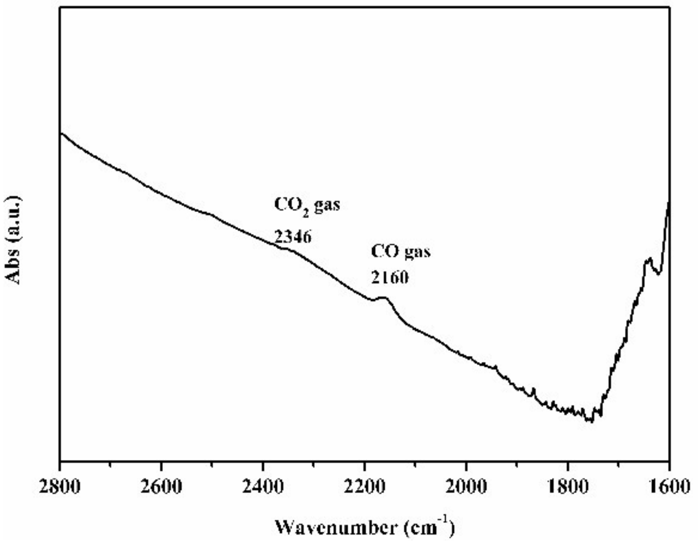


Fig. S7 The infrared transmittance spectrum of the reacted gases over Pd/N-TiO_2 at room temperature in dark with IR cell (seeing Fig.R3).

A Thermo Fisher Scientifc IS50 FT-IR instrument which contains a controlled environment chamber equipped with two CaF_2 windows was employed to record the in situ FT-IR spectra, running in a range of 400–4000 cm^{-1}. An intact and thin self-supporting sample pullet (15 mg) of catalyst was mounted on a holder in the chamber. Before the experiment, this sample was pretreated in a vacuum at 200 ^{o}C for 2 h under a pressure of 10^{-1} Pa. After cooling to room temperature, the absorbed gas (CO and NO) was introduced into the sample. The transmission spectra were recorded by a DTGS KBr detector in the absorbance mode.

As shown in Fig.R7 only two weak bands at 2346 and 2160 cm^{-1} (assigned to CO_2

and CO gas, respectively) appeared, while the N_2O (2235 cm^{-1}) and NCO species (2210 cm^{-1}) were not detected, indicating that all of intermediates (N_2O and NCO) adsorbed at sample could be almost transformed into N_2 and CO_2 in outlet.