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## Supplementary file:

## Micro-kinetic modelling of photocatalytic CO<sub>2</sub> reduction over undoped and N-doped TiO<sub>2</sub>

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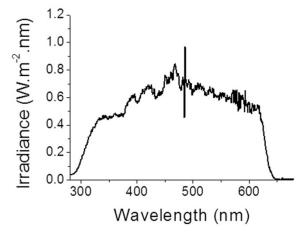


Fig. S1 Total lamp irradiance spectra

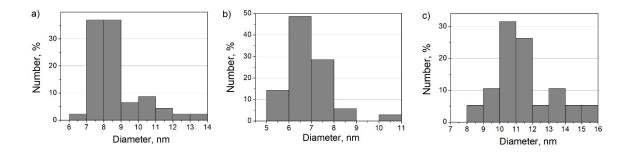


Fig. S3 The particle size distribution of: a) undoped  $TiO_2$ , b) N- $TiO_2(G)$  and c) N- $TiO_2(P)$  catalyst calculated by manual measurement of about 30 particles observed from the TEM images.

$$TiO_{2} \stackrel{hv}{\rightarrow} e^{-} + h^{+}$$

$$H_{2}O_{(g)} \rightarrow H_{2}O_{(ads)} \downarrow h^{+}$$

$$H^{+} + O_{2} \downarrow e^{-}$$

$$H_{2(ads)} \rightarrow H_{2(g)}$$

$$CH^{\bullet}_{(ads)} \stackrel{H^{+} + e^{-}}{\rightarrow} CH_{2(ads)} \stackrel{H^{+} + e^{-}}{\rightarrow} CH_{3}^{\bullet}_{(ads)} \stackrel{H^{+} + e^{-}}{\rightarrow} CH_{4(ads)} \downarrow \downarrow CH_{3}CH_{3(ads)}$$

$$COH^{\bullet} \stackrel{H^{+} + e^{-}}{\rightarrow} C_{(ads)} + H_{2}O$$

$$CH_{3}CH_{2}CH_{3(ads)} \stackrel{CH^{\bullet}}{\rightarrow} CH_{3}CH_{3(g)} \downarrow CH_{3}CH_{3(g)}$$

$$CH_{3}CH_{2}CH_{3(ads)} \stackrel{CH_{3}CH_{2}CH_{3(g)}}{\rightarrow} CH_{3}CH_{3(g)}$$

$$CH_{3}CH_{2}CH_{3(g)}$$

Fig. S3 The reaction pathway scheme. The input reactants  $TiO_2$ ,  $CO_2$  and  $H_2O$  are presented in red, whereas final products  $H_2$ , CO and  $CH_4$  are in blue. As  $CH_3CH_3$  and  $CH_3CH_3$  were produced in negligible amount, they are left in black.a