

Supporting Information

## Surface Basicity of Metal@TiO<sub>2</sub> to Enhance Photocatalytic Efficiency for CO<sub>2</sub> Reduction

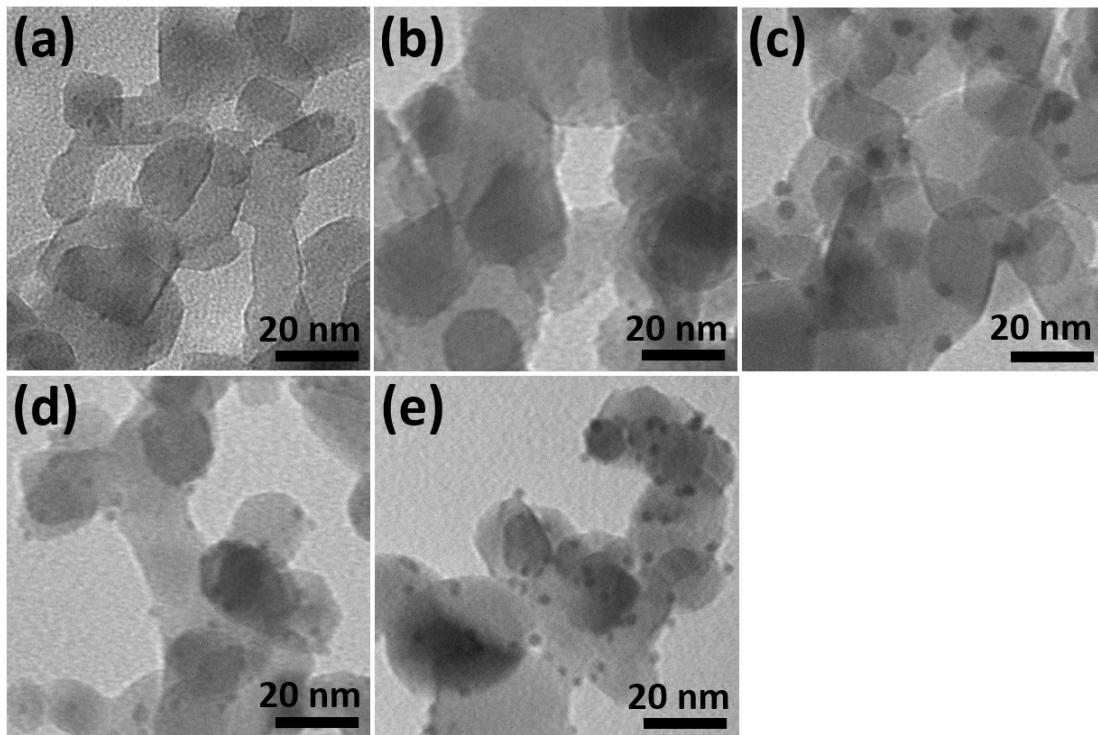
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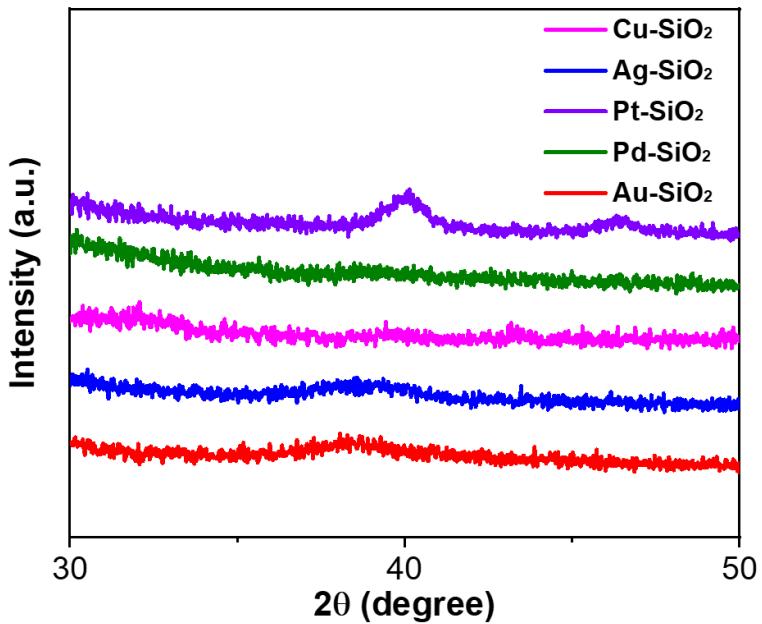
<sup>2</sup>Department of Chemistry, University of New Hampshire, Durham, NH 03824, USA

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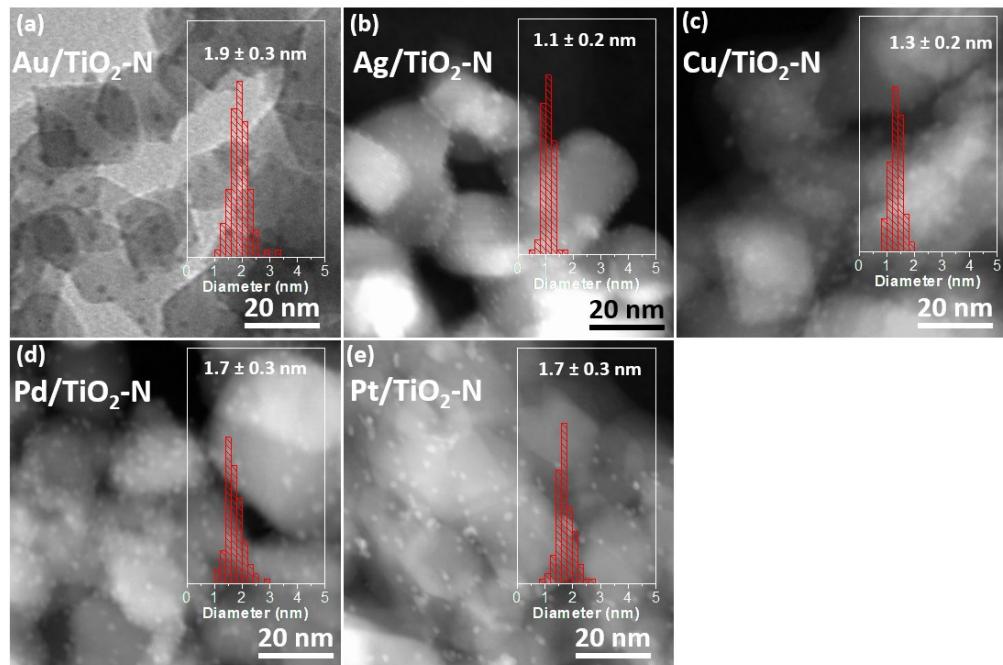
Email: gonghu.li@unh.edu (G.L.); [jie.he@uconn.edu](mailto:jie.he@uconn.edu) (J.H.)



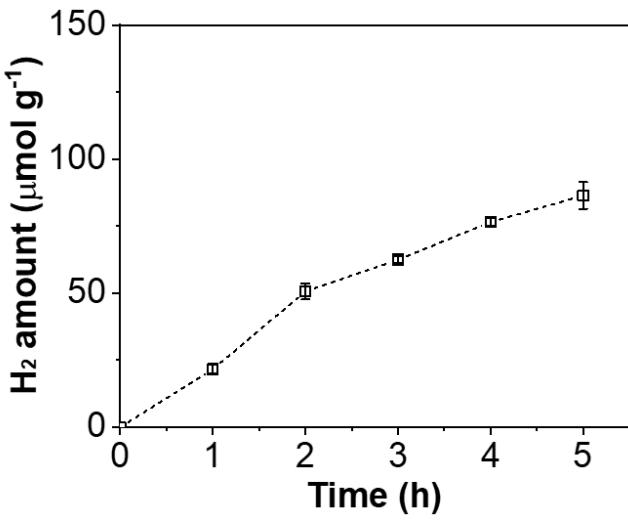
**Figure S1.** Bright-field TEM images of (a) Ag/TiO<sub>2</sub>, (b) Cu/TiO<sub>2</sub>, (c) Au/TiO<sub>2</sub>, (d) Pd/TiO<sub>2</sub>, and (e) Pt/TiO<sub>2</sub>.



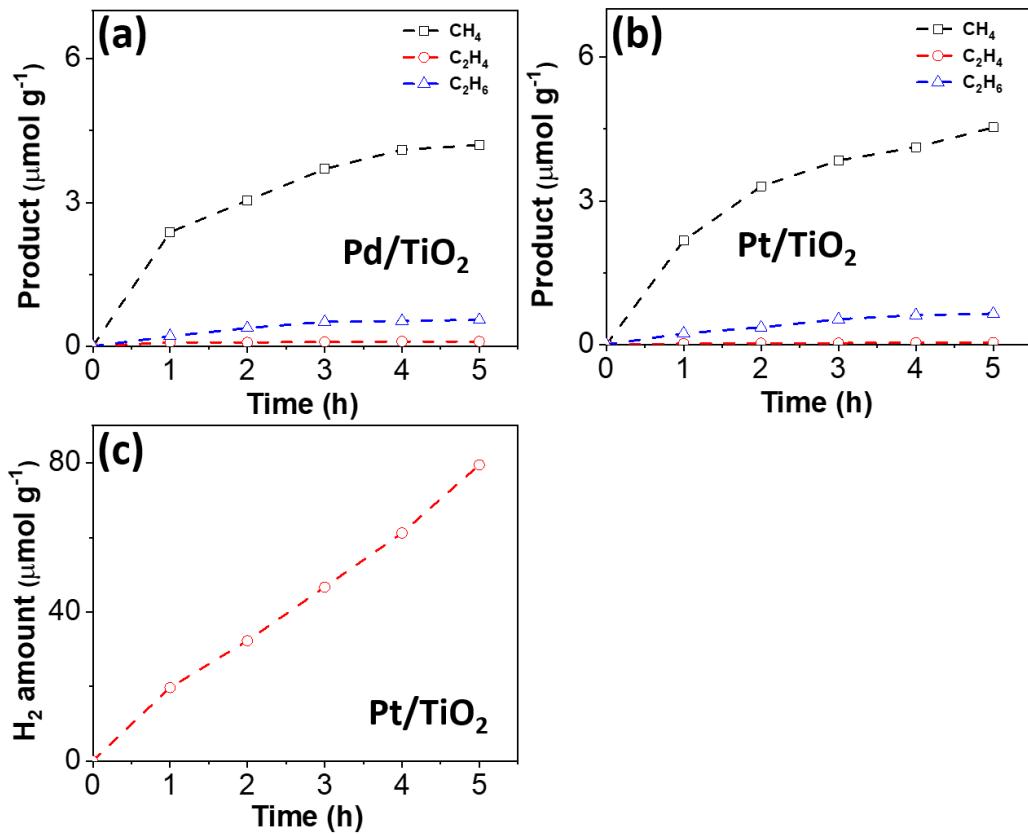
**Figure S2.** XRD patterns of M-SiO<sub>2</sub> via similar method. Broad peaks can be seen which are from the small metal NPs.



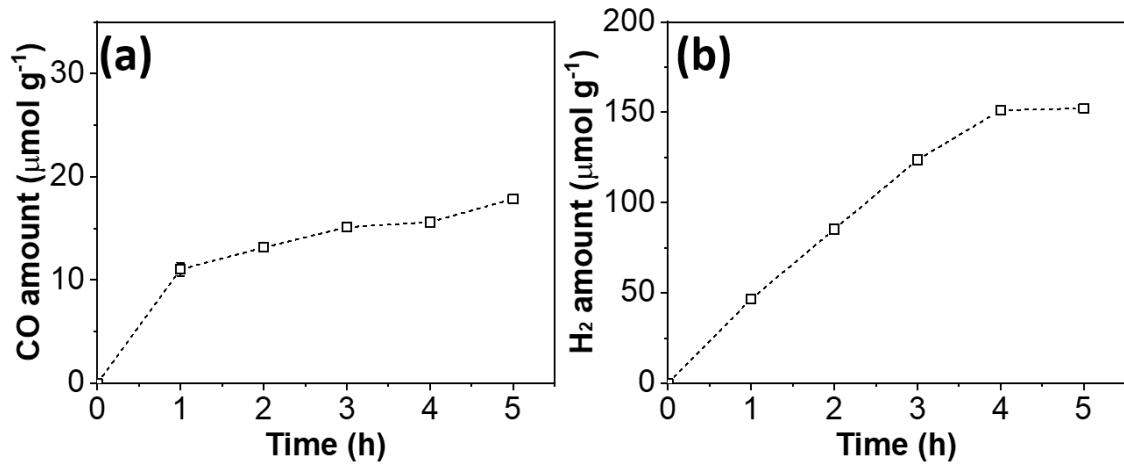
**Figure S3.** TEM images and size distribution of (a) Au/TiO<sub>2</sub>-N, (b) Ag/TiO<sub>2</sub>-N, (c) Cu/TiO<sub>2</sub>-N, (d) Pd/TiO<sub>2</sub>-N, and (e) Pt/TiO<sub>2</sub>-N



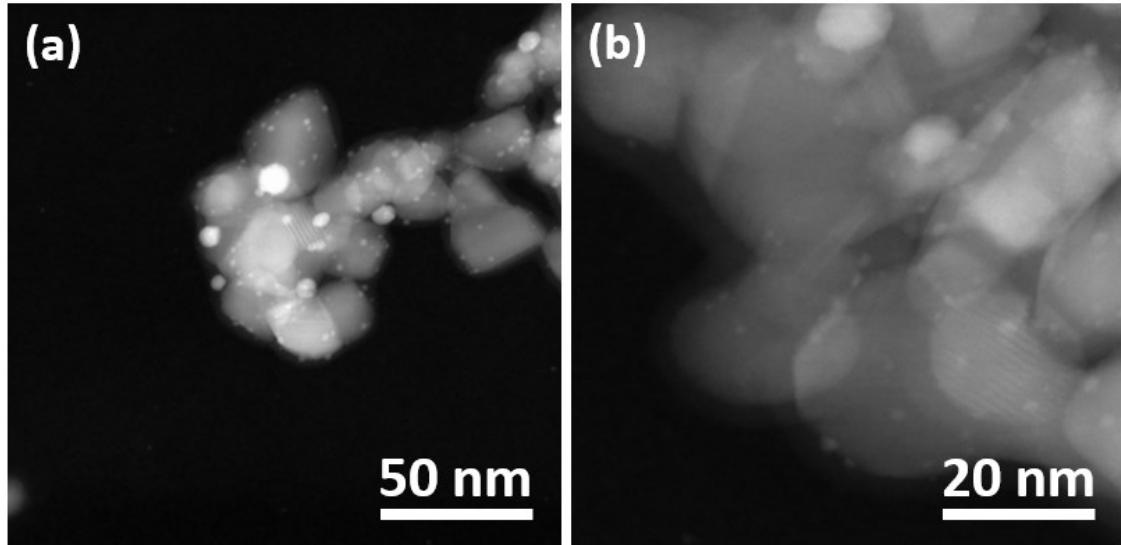
**Figure S4.** H<sub>2</sub> production rate of Au/TiO<sub>2</sub> in photocatalytic CO<sub>2</sub> reduction.



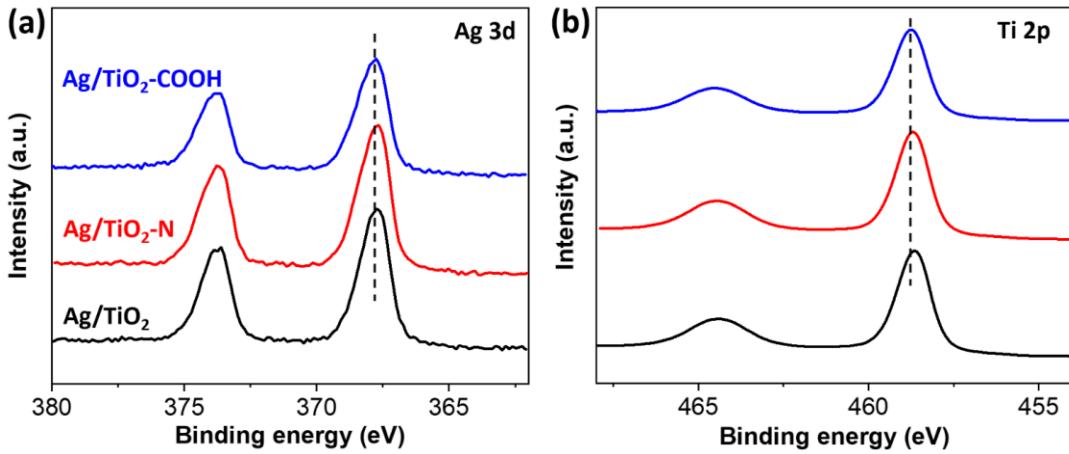
**Figure S5.** Photochemical CO<sub>2</sub> reduction rate of (a) Pd/TiO<sub>2</sub> and (b-c) Pt/TiO<sub>2</sub>.



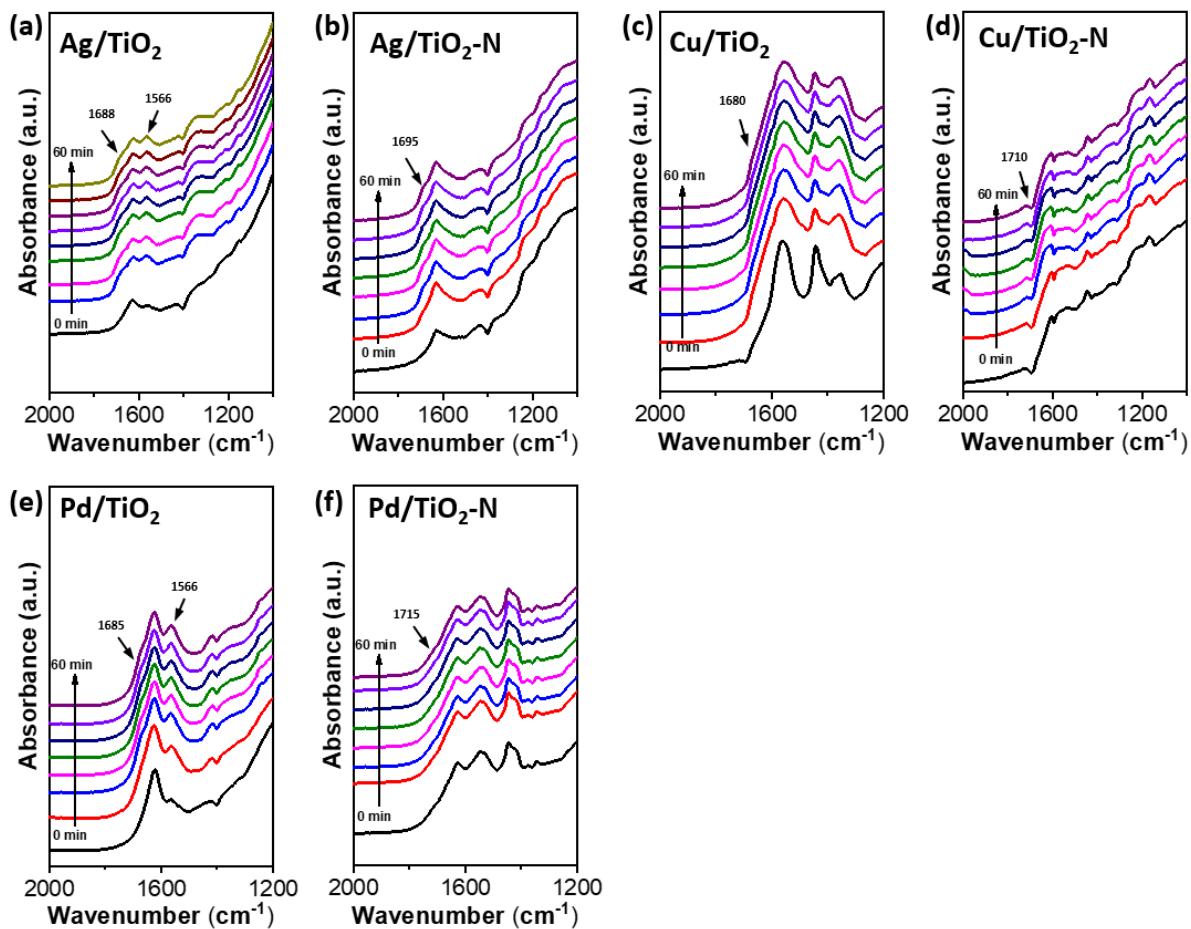
**Figure S6.** (a) CO production and (b)  $\text{H}_2$  production of Au/TiO<sub>2</sub>-N.



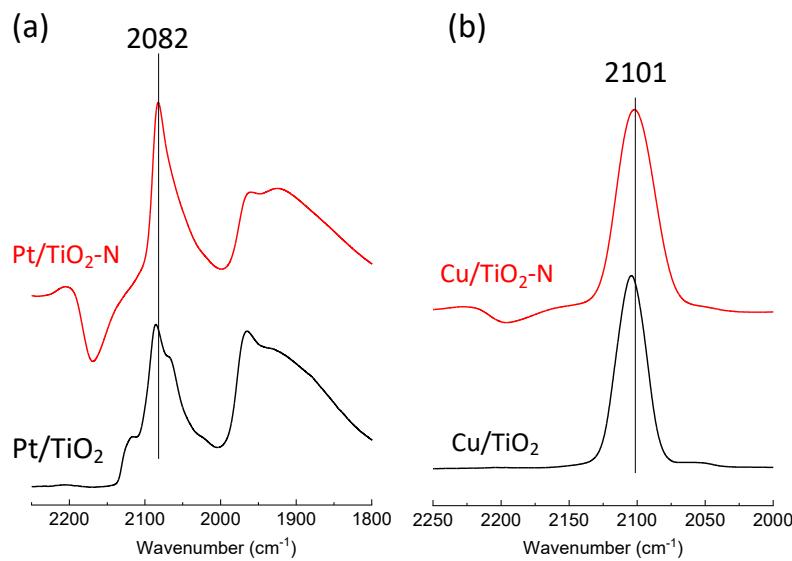
**Figure S7.** (a-b) TEM images of Ag/TiO<sub>2</sub>-N after 5 h reaction.



**Figure S8.** (a) XPS Ag 3d, (b) Ti 2p spectra of Ag/TiO<sub>2</sub>, Ag/TiO<sub>2</sub>-N, and Ag/TiO<sub>2</sub>-COOH.



**Figure S9.** In situ DRIFTS spectra of CO<sub>2</sub> photoreduction on (a) Ag/TiO<sub>2</sub>, (b) Ag/TiO<sub>2</sub>-N, (c) Cu/TiO<sub>2</sub>, (d) Cu/TiO<sub>2</sub>-N, (e) Pd/TiO<sub>2</sub>, and (f) Ag/TiO<sub>2</sub>-N.



**Figure S10.** DRIFTS spectra of CO adsorbed on (a) Pd/TiO<sub>2</sub> and Pd/TiO<sub>2</sub>-N, and (b) Cu/TiO<sub>2</sub> and Cu/TiO<sub>2</sub>-N.

**Table S1.** Metal loading amount of different catalysts

Sample	Feeding ratio (wt.%)	Actual loading (wt.%)*
Ag/TiO <sub>2</sub>		2.2
Ag/TiO <sub>2</sub> -N		2.4
Cu/TiO <sub>2</sub>		1.8
Cu/TiO <sub>2</sub> -N		2.1
Au/TiO <sub>2</sub>		2.1
Au/TiO <sub>2</sub> -N	2.5	2.0
Pd/TiO <sub>2</sub>		1.8
Pd/TiO <sub>2</sub> -N		2.2
Pt/TiO <sub>2</sub>		1.9
Pt/TiO <sub>2</sub> -N		1.8

\*measured from SEM-EDS.