Supporting Information

Plasmonic Nanoparticle-Film-assisted Photoelectrochemical Catalysis across Entire Visible-NIR Region

Junchang Zhang, †a,d Yinghui Sun, †b Rui Feng, †c,f Wenkai Liang, †a Zhiqiang Liang, †a Wei Guo, †a Ibrahim Abdulhalim, †e Jiangying Qu, †d Cheng-Wei Qiu, †c Lin Jiang †a

†a Institute of Functional Nano & Soft Materials Laboratory (FUNSOM), Jiangsu Key Laboratory for Carbon-Based Functional Materials & Devices, Joint International Research Laboratory of Carbon-Based Functional Materials and Devices, Suzhou 215123, Jiangsu, China

†b College of Energy, Soochow Institute for Energy and Materials Innovations & Key Laboratory of Advanced Carbon Materials and Wearable Energy Technologies of Jiangsu Province, Soochow University, Suzhou 215006, Jiangsu, China

†c Department of Electrical and Computer Engineering, National University of Singapore, Singapore 117583, Singapore

†d School of Environment and Civil Engineering, Dongguan University of Technology, Dongguan, Guangdong, 523808, China

†e Department of Electrooptic Engineering and the Ilse Katz Institute for Nanoscale Science and Technology, Ben Gurion University, Beer Sheva 84105, Israel

†f Department of physics, Harbin Institute of Technology, Harbin 150001, China
*These authors contributed equally to this work.

*E-mail: ljiang@suda.edu.cn; chengwei.qiu@nus.edu.sg
**Figure S1.** Top-view SEM image of (a) 30 nm and (b) 60 nm Au NP-film on TiO$_2$ film; TEM images of Au NP-film transferred from the water/heptane interface and a statistical graph of the distribution of the interparticle distance for Au NPs with diameters of (c) 30 nm, (d) 60 nm.
Figure S2. Cross-section SEM image of (a) TiO$_2$/30Au/TiO$_2$ and (b) TiO$_2$/60Au/TiO$_2$ sandwiched structure on FTO glass.

Figure S3. XRD patterns of TiO$_2$/xAu/TiO$_2$ (x=30 nm, 60 nm and 90 nm) photoanodes.
**Figure S4.** Amperometric $I-t$ curves at 0.75 V vs RHE under illumination of visible-NIR light for TiO$_2$/90Au/TiO$_2$ photoanodes with different top thickness of TiO$_2$.

**Figure S5.** The weighted superposition of the normalized electric field intensities of (a) 30 nm, (b) 60 nm, (c) 90 nm Au NP-film in logarithmic scale. The weighted superpositions were calculated by weighting the normalized electric field intensity according to their relative intensities of solar irradiance. ($\log_{10}(E/E_0^2)$). (d) The
integration of the weighted superpositions of the normalized electric field intensity in
the middle section.

Figure S6. Photocurrents vs time (I-t) curves of TiO$_2$ (black line) and
TiO$_2$/90Au/TiO$_2$ (red line) photoanodes under (a) 500 nm, (b) 630 nm, (c) 790 nm and
(d) 970 nm light illumination.
Figure S7. H$_2$ generation by TiO$_2$ and TiO$_2$/90Au/TiO$_2$ under illumination of visible-NIR light for 24 h (AM 1.5G, 500 mW/cm$^2$).