

## **Supplementary Materials**

### **Laser Irradiation-Induced Pt-Based Bimetallic Alloy Nanostructures Without Chemical Reducing Agents for Hydrogen Evolution Reaction**

Taiping Hu<sup>1,2#</sup>, Yisong Fan<sup>3,4,5#</sup>, Yixing Ye<sup>1</sup>, Yunyu Cai<sup>1</sup>, Jun Liu<sup>1</sup>, Yao Ma<sup>1</sup>, Pengfei Li<sup>1\*</sup>, Changhao Liang<sup>1,2\*</sup>

<sup>1</sup> Key Laboratory of Materials Physics and Anhui Key Laboratory of Nanomaterials and Nanotechnology, Institute of Solid State Physics, Hefei Institutes of Physical Science, Chinese Academy of Sciences, Hefei 230031, China.

<sup>2</sup> Department of Materials Science and Engineering, University of Science and Technology of China, Hefei 230026, China

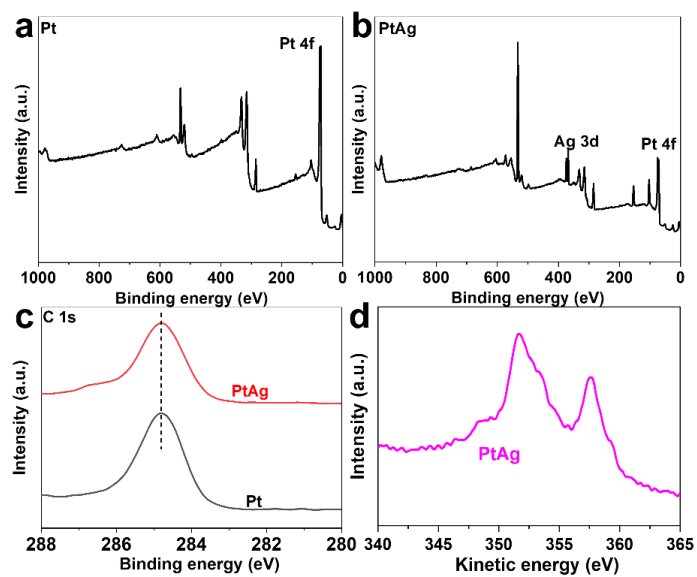
<sup>3</sup> Anhui Provincial Key Laboratory of Photonic Devices and Materials, Anhui Institute of Optics and Fine Mechanics, Hefei Institutes of Physical Science, Chinese Academy of Sciences, Hefei, 230031, China

<sup>4</sup> Advanced Laser Technology Laboratory of Anhui Province, National University of Defense Technology, Hefei, 230037, China

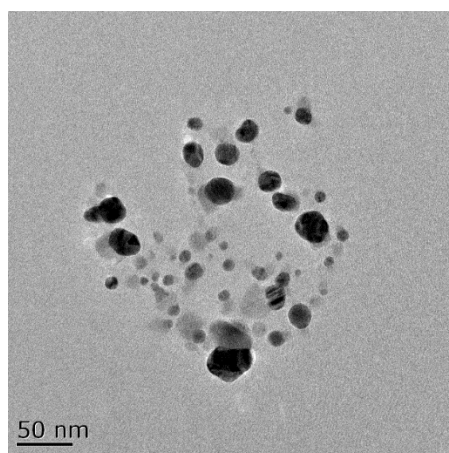
<sup>5</sup> School of Chemistry and Materials Science, University of Science and Technology of China, Hefei 230026, China

\*Corresponding authors

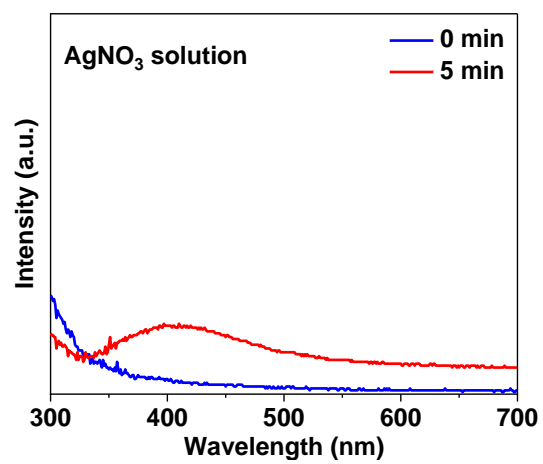
E-mail: chliang@issp.ac.cn; [pfli@issp.ac.cn](mailto:pfli@issp.ac.cn). <sup>#</sup> These authors contributed equally to this work.



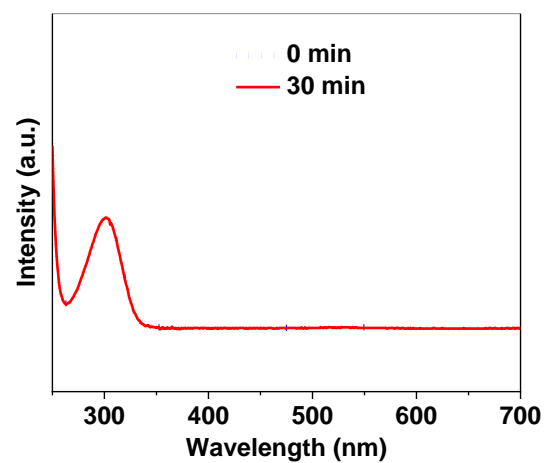
**Figure S1.** (a-b) XPS spectrum of Pt and PtAg alloys, (c) C 1s of Pt and PtAg alloys, (d) the auger electron spectrum of Ag for PtAg alloys.



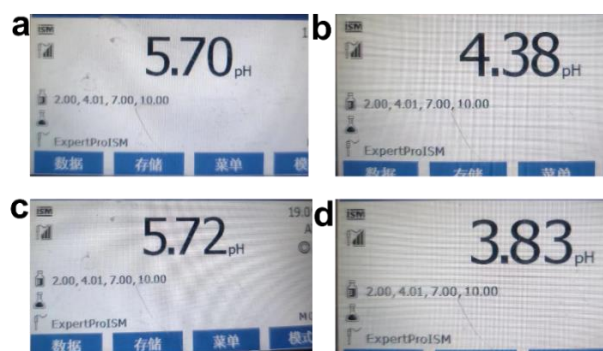
**Figure S2.** The Ag NPs were obtained by irradiating the  $\text{AgNO}_3$  solution with laser irradiation.



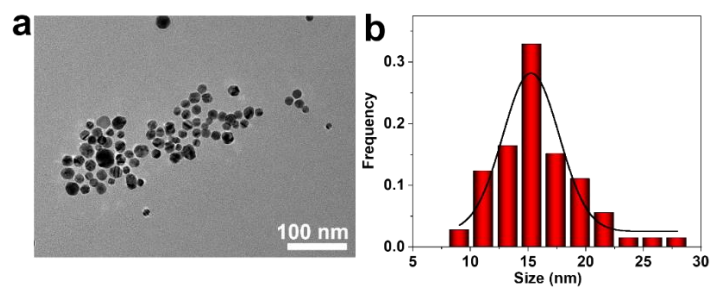
**Figure S3.** UV-vis absorption spectra of AgNO<sub>3</sub> solution irradiated by laser.



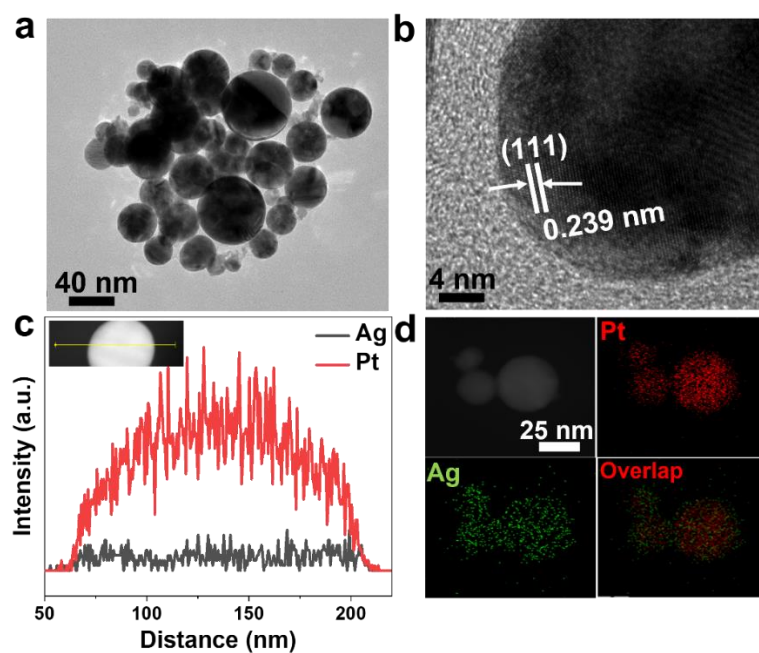
**Figure S4.** UV-vis absorption spectra of  $\text{AgNO}_3$  solution irradiated by a 300W Xenon lamp with a wavelength of 520 nm .



**Figure S5.** The pH of  $\text{AgNO}_3$  solution (125mg/L) (a) initial (b) after 5 min of laser irradiation. The pH of the intermixture of bulk Pt and  $\text{AgNO}_3$  solution (125mg/L) (c) initial (d) after 5 min of laser irradiation.

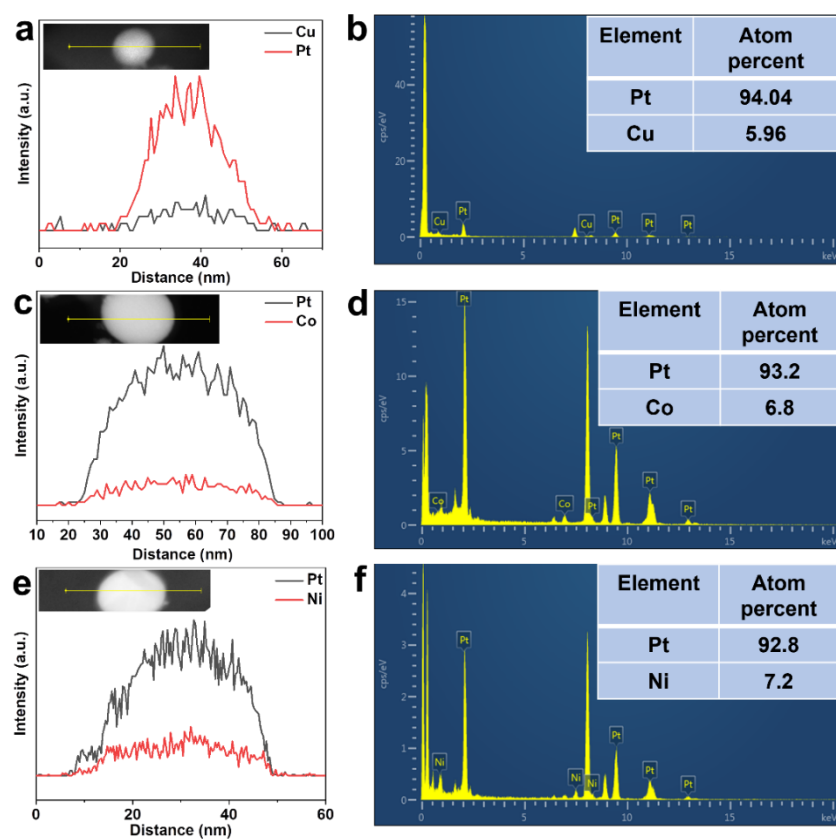


**Figure S6.** TEM images and histogram of size distribution of Ag NPs.

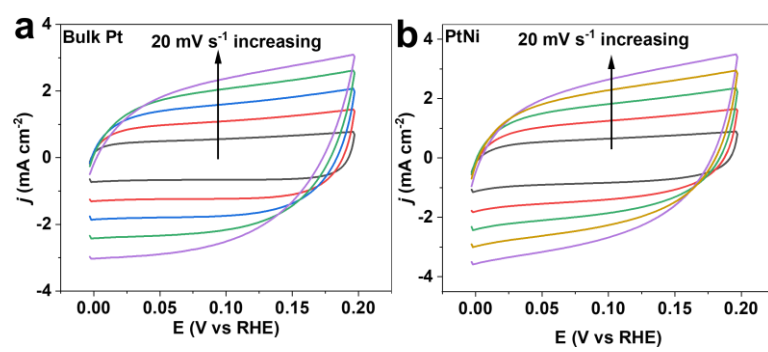


**Figure S7.** (a) TEM image of PtAg alloy NPs, (b) the HRTEM image of PtAg alloy NPs, (c-d) EDX line scans and EDS mapping of PtAg alloy NPs.





**Figure S8.** EDX line scans and EDX energy spectrum of PtX (X=Cu, Co, Ni) alloy NMs, **(a-b)** PtCu alloys, **(c-d)** PtCo alloys, **(e-f)** PtNi alloys.



**Figure S9.** Cyclic voltammetry curves at scan rates ranging from 20 to 100  $\text{mV s}^{-1}$  for (a) the bulk Pt, (b) PtNi alloy.