## **Supporting Information**

# Silver and Palladium Alloy Nanoparticles Catalysts: Reductive coupling of Nitrobenzene through Light Irradiation

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Figure S1. TEM image of (a) Ag-Pd(1:1)/ZrO<sub>2</sub> catalyst; (b) Ag-Pd(1:1)/Al<sub>2</sub>O<sub>3</sub> catalyst.

(b)

Electron Image 1



Zr Lα1



500µm ٦

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Ag Lα1





**Figure S2.** (a) SEM image of Ag-Pd(1:1) /ZrO<sub>2</sub> sample and the corresponding mapping of Zr, Ag and Pd elements.; (b) EDX spectrum of Ag-Pd(1:1) /ZrO<sub>2</sub> sample.

Entry	Catalyst	Ag	Pd	Ag:Pd ratio		
		(Wt%)	(Wt%)	Calculated Wt. Ratio	Experimental Wt. Ratio	Calculated molar Ratio
1	Ag:Pd(2:1)	2	1	2:1	1.89:1	1.97:1
2	Ag:Pd(1:1)	1.5	1.5	1:1	1:1.01	1:1.01
3	Ag:Pd(1:2)	1	2	1:2	1:1.78	1:2.03
4	Ag	3	0	1:0	1:0	1:0
5	Pd	0	3	0:1	0:1	0:1

Table S1: The calculated corresponding Au-Pd molar in photocatalysts- ZrO<sub>2</sub> and Al<sub>2</sub>O<sub>3</sub>.

The alloy photocatalysts with different Ag and Pd contents, pure Ag and pure Pd catalyst supported by  $ZrO_2/Al_2O_3$  were also prepared in the impregnation-reduction method for reference. The corresponding Ag-Pd molar ratios were calculated and calculated Ag-Pd weight ratios were compared with an experimental weight ratio obtains via SEM- EDX spectrum.

#### **Characterization of products**

The products were identified using an Agilent 6980 gas chromatography (GC) coupling with an Agilent HP5973 mass spectrometer equipped with a HP-5 column. Reference mass spectra from Scifinder are provided for comparison. Nevertheless spectra may reflect different instrument/ ionization methods:

a) 4-Methoxybenzenamine- m/z for C<sub>7</sub>H<sub>9</sub>NO is 123.15



Reference spectrum of 4-Methoxybenzenamine found from SciFinder:







Reference spectrum of Azobenzene, 4,4'-dimethoxy found from SciFinder:







Reference spectrum of 4-Bromobenzenamine found from SciFinder:



### d) 4-Methylbenzenamine - m/z for C<sub>7</sub>H<sub>9</sub>N is 107.0



Reference spectrum of 4-Methylbenzenamine found from SciFinder:



### e) 4-Chlorobenzenamine- m/z for C<sub>6</sub>H<sub>6</sub>ClN is 127.0



Reference spectrum of 4-Chlorobenzenamine found from SciFinder:





### f) Azobenzene, 4,4'-dichloro- m/z for $C_{12}H_8Cl_2N_2$ is 251.1

Reference spectrum of Azobenzene, 4,4'-dichloro- found from SciFinder:



### g) 4-Iodobenzenamine - m/z for C<sub>6</sub>H<sub>6</sub>IN is 218.9



Reference spectrum of 4-Iodobenzenamine found from SciFinder:



### h) Aniline - m/z for C<sub>6</sub>H<sub>7</sub>N is 93.0



Reference spectrum of Aniline found from SciFinder:



#### i) Azobenzene - m/z for $C_{12}H_{20}N_2$ is 182.2



Reference spectrum of Azobenzene found from SciFinder:



### j) 4-Aminobenzonitrile - m/z for $C_7H_6N_2$ is 118.1



Reference spectrum of 4-Aminobenzonitrile found from SciFinder:

