Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting information

Pd/Ag and Pd/Au bimetallic nanocatalysts on mesoporous silica for plasmon-mediated enhanced catalytic activity under visible light irradiation

Priyanka Verma,[a] Yasutaka Kuwahara,[a,b] Kohsuke Mori, [a,b,c] and Hiromi Yamashita*[a,b]

AUTHOR ADDRESS:

[a] Division of Materials and Manufacturing Science, Graduate School of Engineering, Osaka University, 2-1 Yamadaoka, Suita, Osaka 565-0871, Japan.
E-mail: yamashita@mat.eng.osaka-u.ac.jp;
Fax: +81-6-6879-7457; *Tel:* +81-6-6879-7457

[b] Elements Strategy Initiative for Catalysts & Batteries Kyoto University, ESICB, Kyoto University, Katsura, Kyoto 615-8520, Japan

[c] JST, PRESTO, 4-1-8 Honcho, Kawaguchi, Saitama, 332-0012 (Japan)

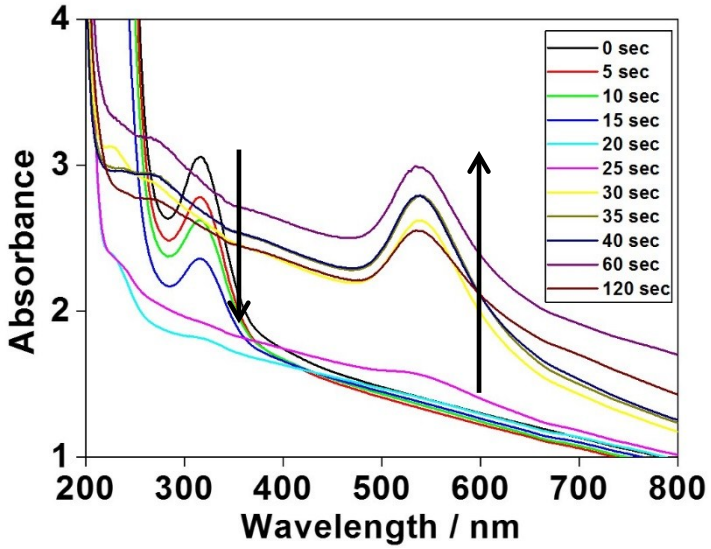

Figure S1. Time evolution of MW irradiation for the reduction of $HAuCl_4$ to Au NPs on a mesoporous silica support

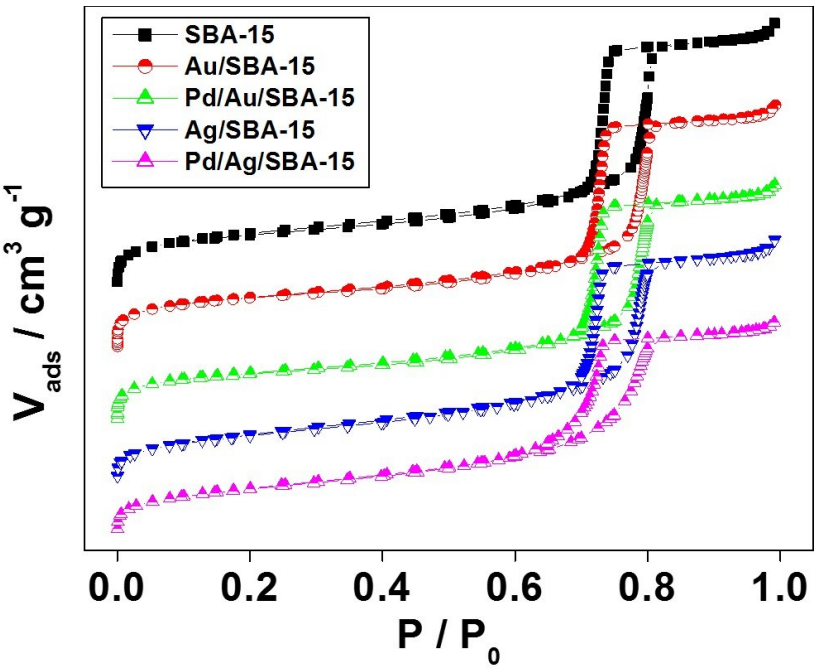

Figure S2. N_2 adsorption-desorption isotherms performed at 77 K for SBA-15, M/SBA-15 and Pd/M/SBA-15 catalysts (M=Au, Ag).

Table S1. Textural properties of the prepared catalysts

Catalyst	Mesopore volume (cm^3g^{-1})	BET surface area (m^2g^{-1})
SBA-15	1.32	756
Au/SBA-15	1.21	668
Pd/Au/SBA-15	1.18	642
Ag/SBA-15	1.24	717
Pd/Ag/SBA-15	1.10	692

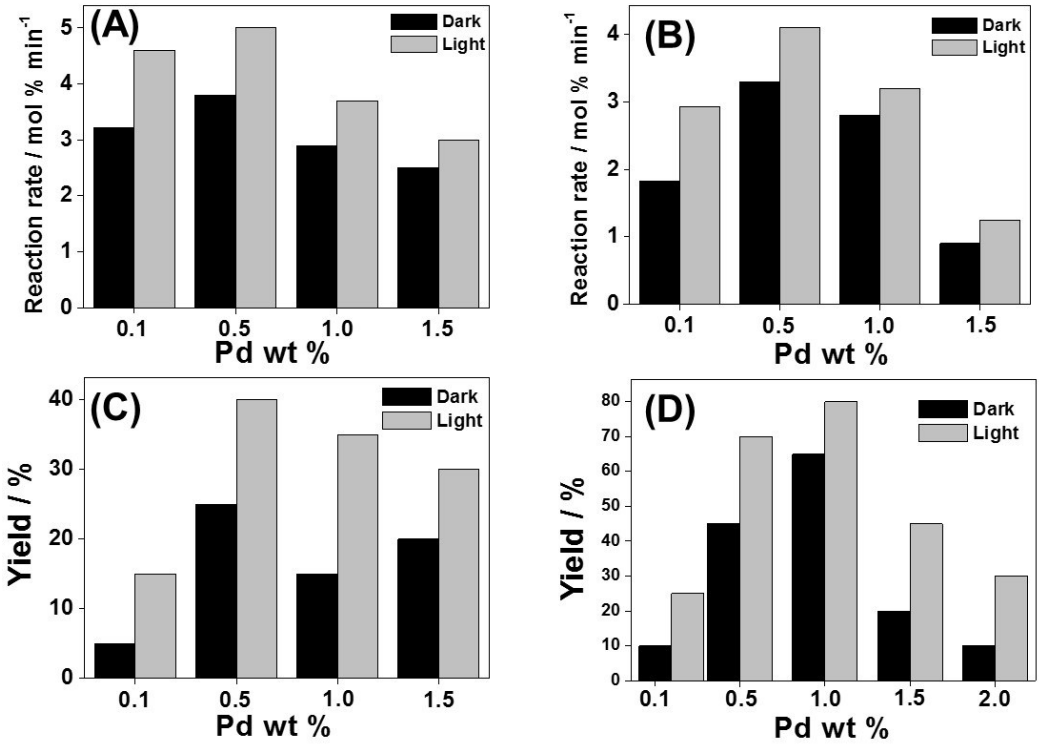

Figure S3. Optimization reactions for AB dehydrogenation **(A)** Pd on Ag, **(B)** Pd on Au and Suzuki coupling reaction **(C)** Pd on Ag, **(D)** Pd on Au.

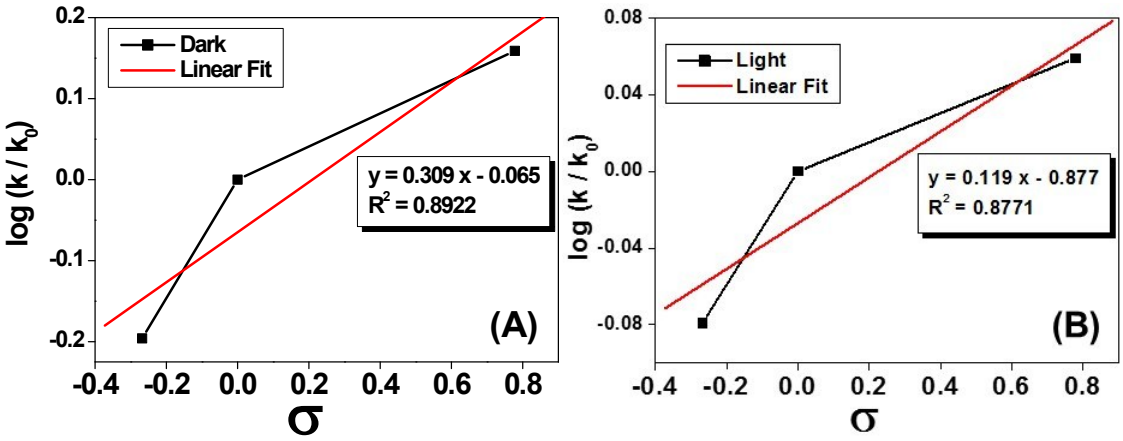

Figure S4. Hammett plot corresponding to Suzuki Miyaura coupling reaction for substituted iodobenzene under (A) Dark and (B) visible light irradiation

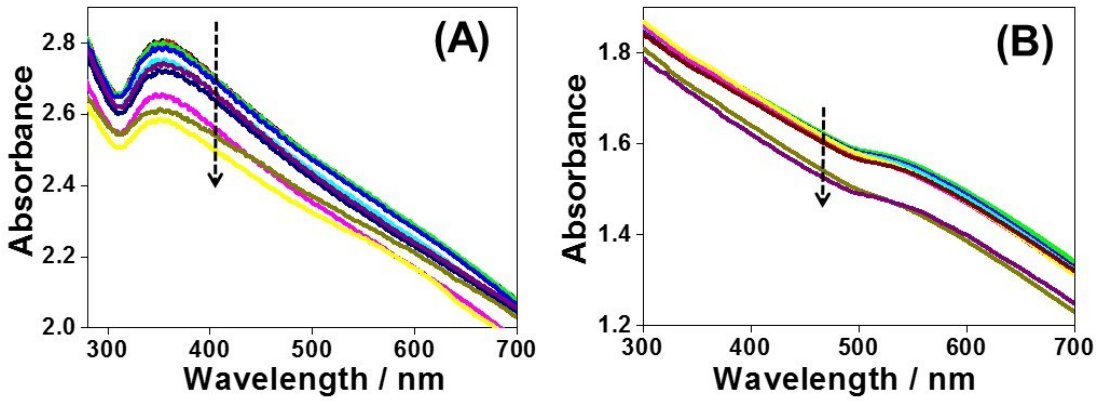

Figure S5. UV-vis spectra of (A) Pd/Ag/SBA-15 and (B) Pd/Au/SBA-15 as a result of electron injection experiments.

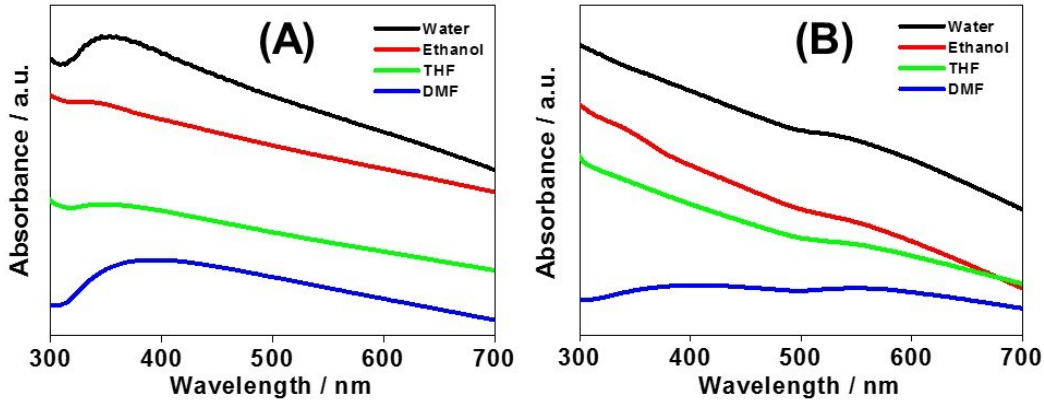

Figure S6. Effect of refractive index of solvent on plasmonic wavelength for (A) Pd/Ag/SBA-15 and (B) Pd/Au/SBA-15

Section S1. Tunability Experiments

a) **Tunability by electron injection:** Tunability by electron injection was measured by in-situ UV-vis spectroscopy measurements. The reaction was carried out in quartz cell by adding 5 mg of plasmonic catalyst (M/SBA-15) and 2.5 mL of water. The process was monitored by UV after the successive addition (10 µL) of 0.132 M sodium borohydride (used as electron injector in this case). The spectra obtained from Ag and Au after electron injection are shown in Fig. 8 (A) and (B).

b) **Tunability by varying refractive index:** In a quartz cell, 5 mg of the catalyst powder was dispersed in solvents of different refractive index and their interaction with incoming light was again monitored by UV-vis spectroscopy. Different plasmonic peak showed in different solvents and found to be a linear relationship of

the refractive index and plasmonic shift. Corresponding absorbance shift and linear graph is shown in Fig. 9 (A) and (B) for Ag and Au.

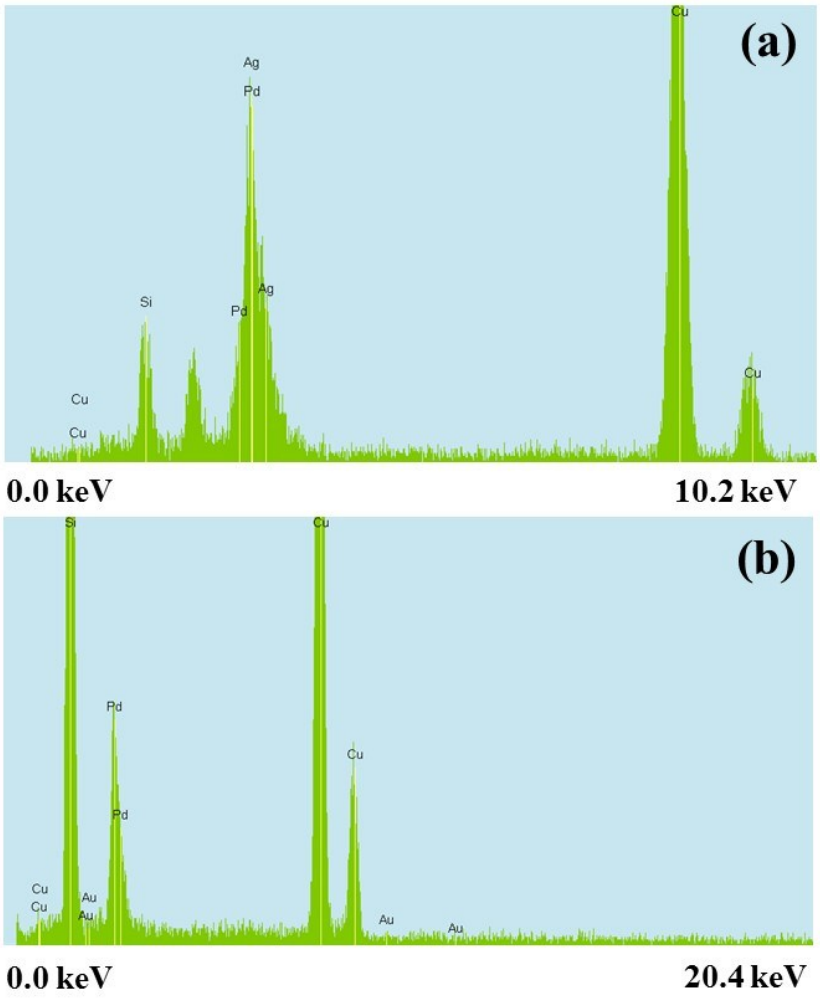

Figure S7. TEM-EDX analysis for (a) Pd/Ag/SBA-15 and (b) Pd/Au/SBA-15