SUPPORTING INFORMATION

Light-Activated Ullmann Coupling of Aryl Halides Catalyzed Using Gold Nanoparticle-Functionalized Potassium Niobium Oxides

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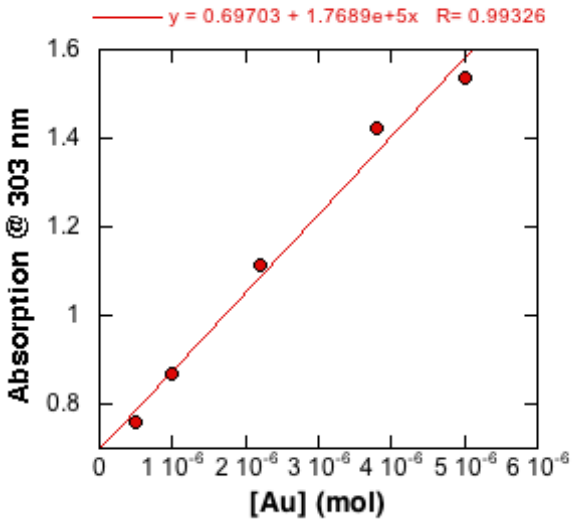

$$\text{mol } HAuCl_4 \bullet 3H_2O \times \frac{196.97 \frac{g}{mol} \text{ Au}}{393.83 \frac{g}{mol} HAuCl_4 \bullet 3H_2O}$$

$$\text{mol } \cancel{HAuCl_4 \bullet 3H_2O} \times 0.5001 \frac{\text{Au}}{\cancel{HAuCl_4 \bullet 3H_2O}}$$

$$\therefore \textbf{mol } \mathbf{HAuCl_4 \bullet 3H_2O} \times \mathbf{0.5001} = \textbf{mol Au}$$

Figure S1. Calibration curves used in the determination of % Au loading. Au^{3+} standards were prepared using a $HAuCl_4 \bullet 3H_2O$ precursor. Determination of Au content can be calculated using the illustrated ratio calculation.

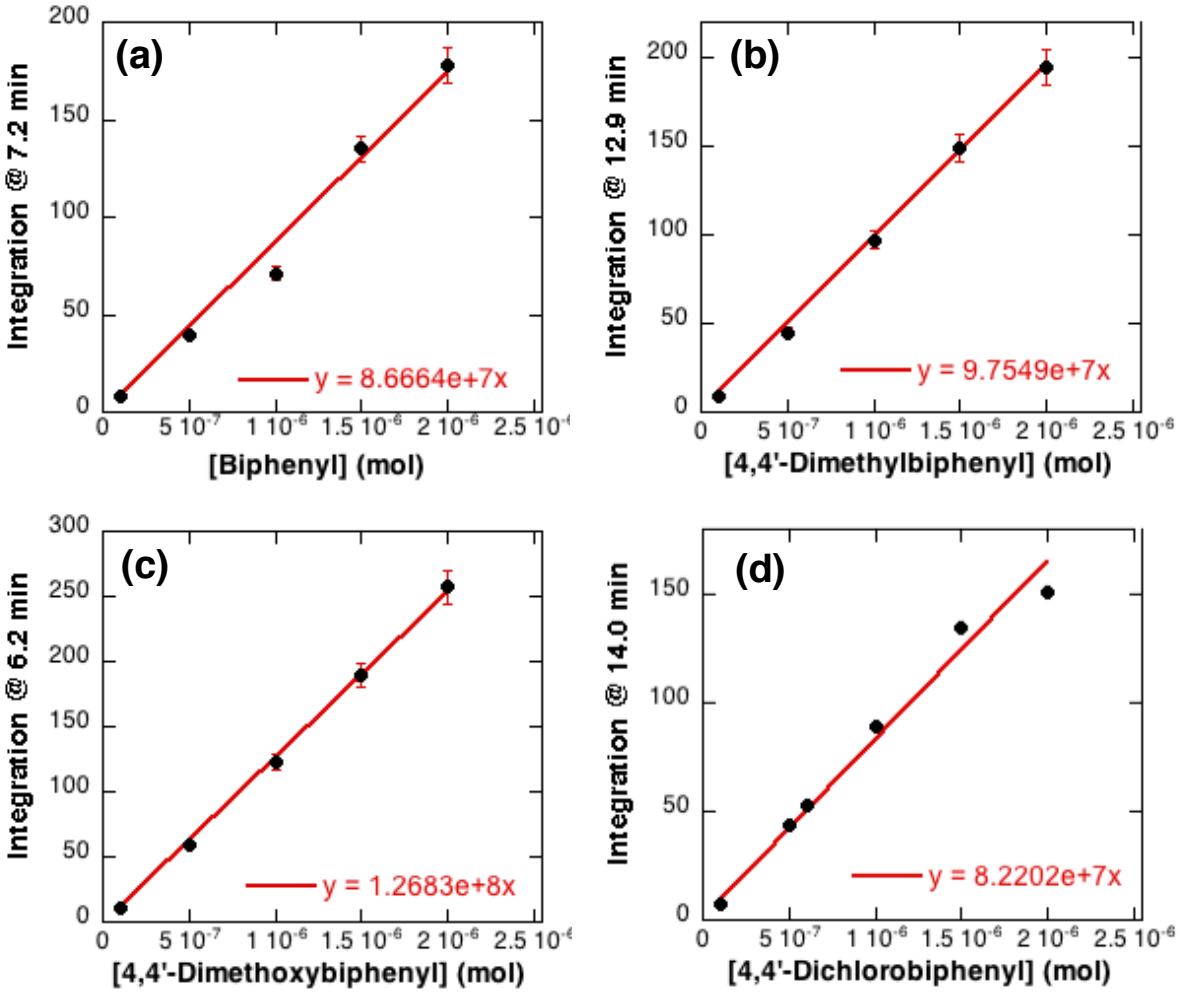

Figure S2. Calibration curves for (a) biphenyl, (b) 4,4'-dimethylbiphenyl, (c) 4,4'-dimethoxybiphenyl and (d) 4,4'-dichlorobiphenyl generated using authentic commercial standards and HPLC chromatogram integrations.

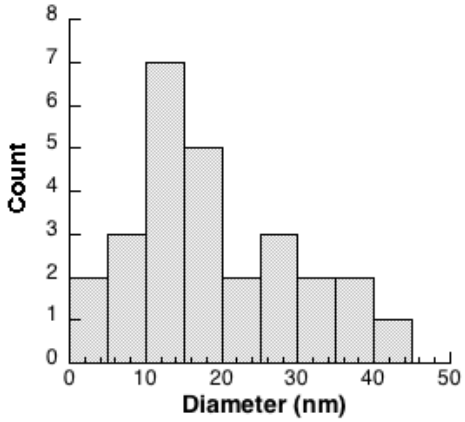

Figure S3. Particle distribution of photochemically (I-2959) synthesized AuNP@KNb_3O_8. Average diameter: 17.9 ± 10.1 nm.

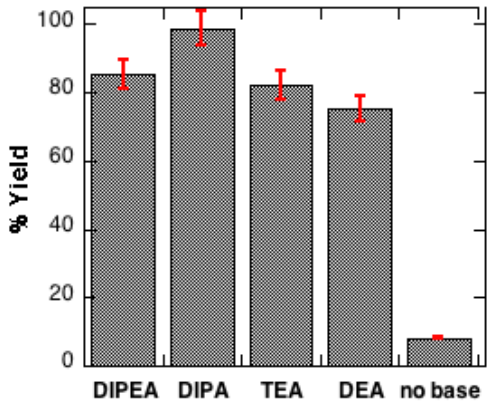

Figure S4. Percent biphenyl yield obtained in the presence of various amine sacrificial oxidants. Reaction conditions: 30 mg AuNP/KNb_3O_8, 3 μmol iodobenzene, 3 μmol aliphatic amine, 3 mL of CH_3OH, 2 hours UVA irradiation.

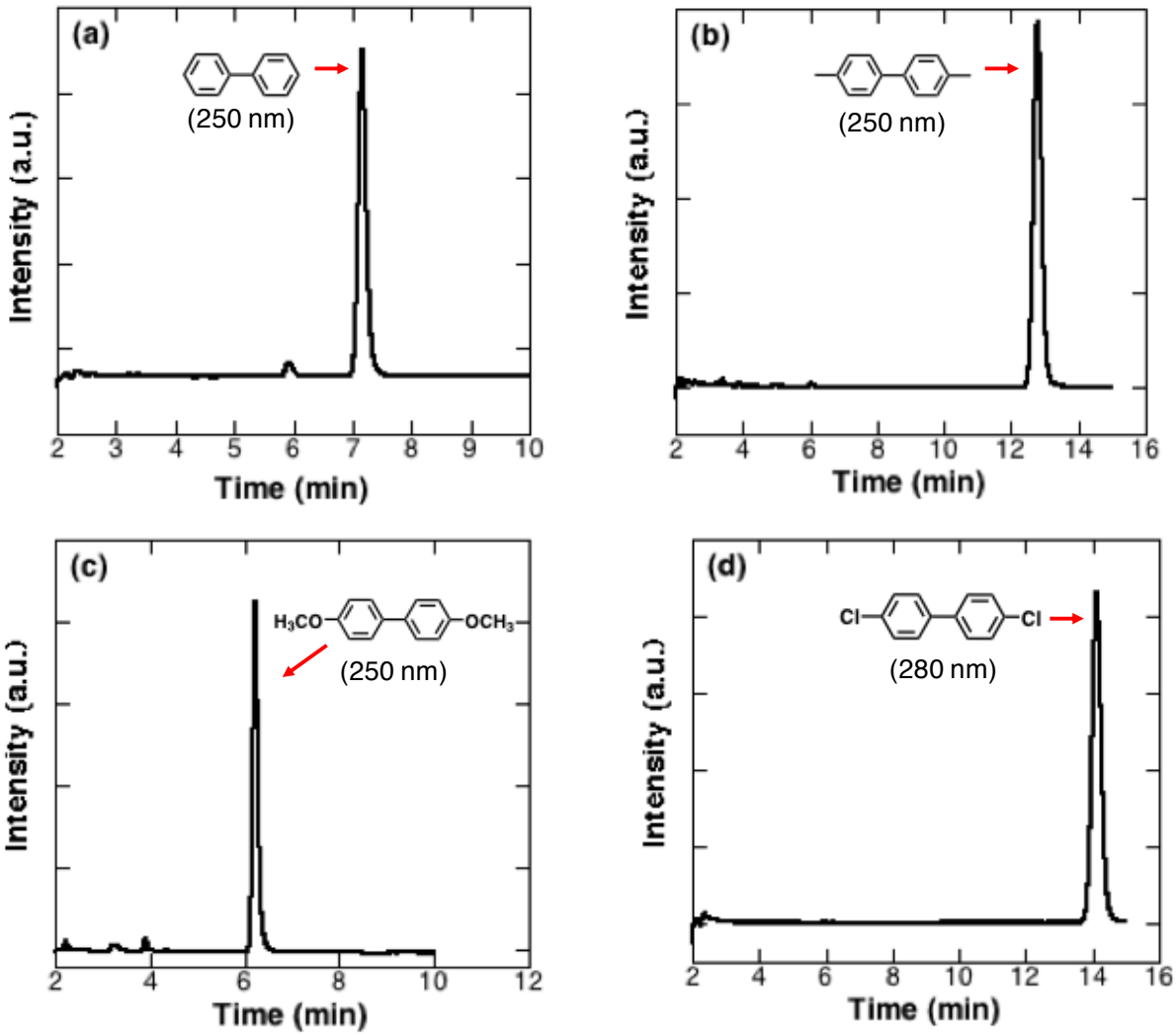

Figure S5. Representative HPLC chromatograms of AuNP/KNb_3O_8-catalyzed Ullmann homocoupling to form (a) biphenyl (Table 2, entry 1), (b) 4,4'-dimethylbiphenyl (Table 2, entry 4), and (c) 4,4'-dimethoxybiphenyl (Table 2, entry 5) and (d) 4,4'-dichlorobiphenyl (Table 2, entry 7). Reaction conditions: aryl halide (3 μmol), AuNP/KNb_3O_8 (30 mg), DIPA (3 μmol), 3 mL CH_3OH, ambient temperature, N_2 atmosphere, 1 hr UVA irradiation. Detector wavelengths are shown in parentheses.

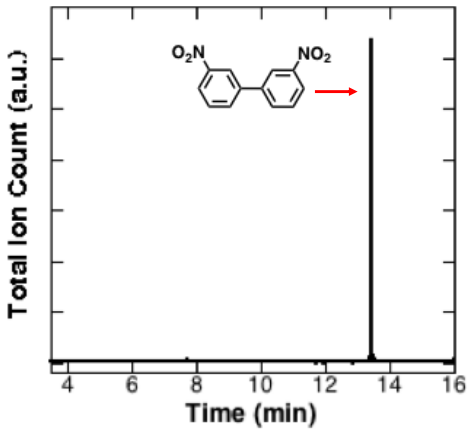

Figure S6. Representative GC-MS of AuNP/KNb_3O_8-catalyzed Ullmann homocoupling to form 3,3'-dinitrobiphenyl (Table 2, entry 6). Reaction conditions: aryl halide (3 μmol), AuNP/KNb_3O_8 (30 mg), DIPA (3 μmol), 3 mL CH_3OH, ambient temperature, N_2 atmosphere, 1 hr UVA irradiation.

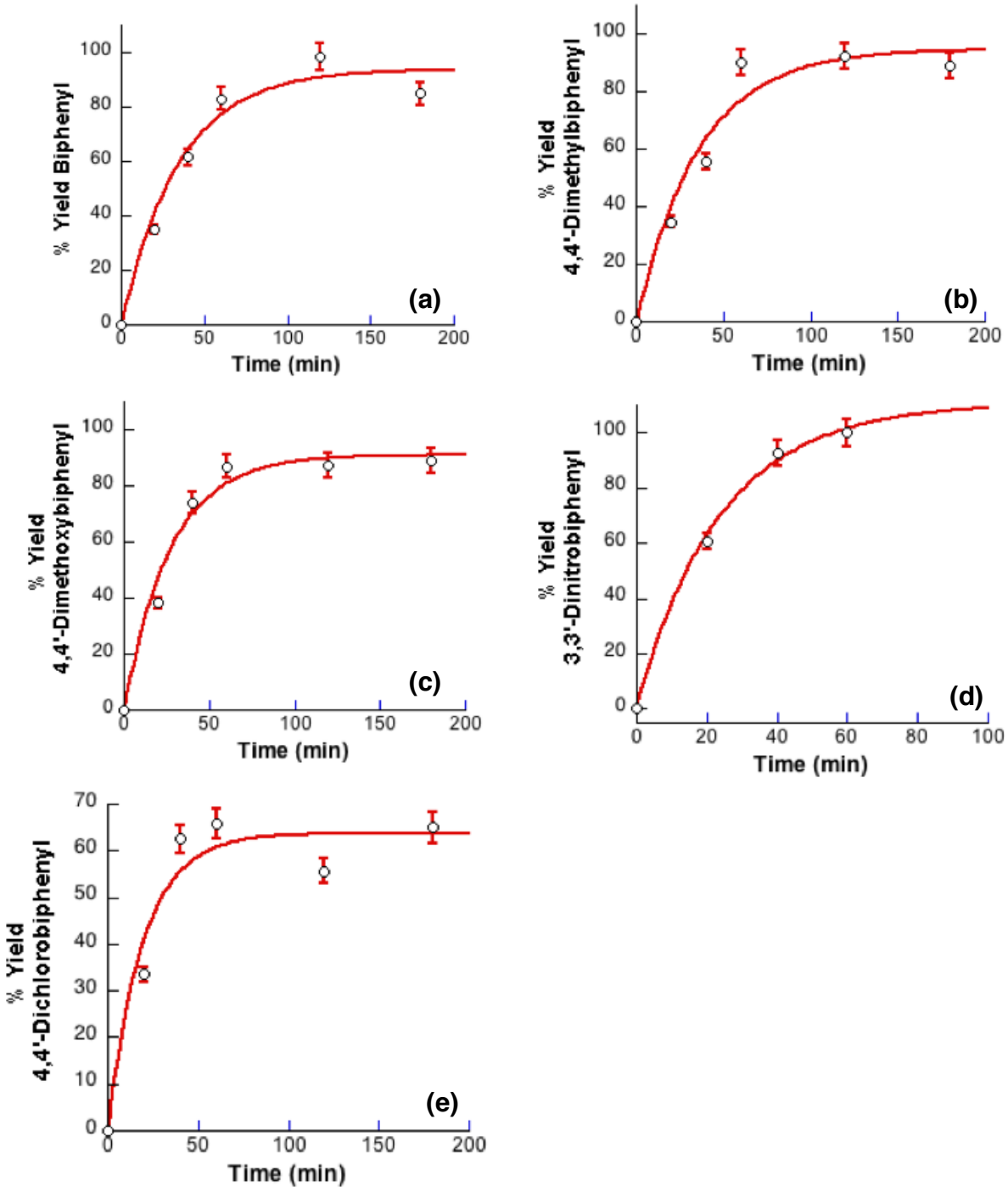

Figure S7. Time monitored formation of AuNP/KNb_3O_8-catalyzed Ullmann homocoupling to form (a) biphenyl (Table 2, entry 1), (b) 4,4'-dimethylbiphenyl (Table 2, entry 4), and (c) 4,4'-dimethoxybiphenyl (Table 2, entry 5), (d) 3,3'-dinitrobiphenyl (Table 2, entry 6) and (e) 4,4'-dichlorobiphenyl (Table 2, entry 7). Reaction conditions: aryl halide (3 μmol), AuNP/KNb_3O_8 (30 mg), DIPA (3 μmol), 3 mL CH_3OH, ambient temperature, N_2 atmosphere.

Figure S8. Photo of photochemically (I-2959) reduced AuNP@KNb_3O_8 catalyst.