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Supporting Information

PdAu Nanosheets for Visible Light Driven Suzuki Cross-Coupling

Reactions

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Figure S1: Emission Spectra of LED light



Figure S2: EDX of PdAu 10:1 NS's.



Figure S3: XRD of Pd and PdAu 5:1 NS's

Moles of Pd	Moles of Au	Moles of surfactant	Moles of AA Temp (c)		Time	Results
1.6x10 ⁻⁵	-	2.5x10 ⁻⁴	3x10 ⁻⁴	0°C	6h	Nanoparticle
						formation
1.6x10 ⁻⁵	-	5x10 ⁻⁴	3x10 ⁻⁴	0°C	6h	Nanoparticle
						formation
1.6x10 ⁻⁵	-	2.5x10 ⁻⁴	3x10 ⁻⁴	0°C	3h	No reduction
1.6x10 ⁻⁵	-	5x10 ⁻⁴	3x10 ⁻⁴	0°C	3h	No reduction
8x10 ⁻⁶	-	2.5x10 ⁻⁴	3x10 ⁻⁴	0°C	6h	NS formation
8x10 ⁻⁶	-	5x10 ⁻⁴	3x10 ⁻⁴	0°C	6h	NS and NP
8x10 ⁻⁶	-	2.5x10 ⁻⁴	3x10 ⁻⁴	0°C	3h	NS and NP
8x10 ⁻⁶	-	5x10 ⁻⁴	3x10 ⁻⁴	0°C	3h	NS and NP
1.6x10 ⁻⁵	-	2.5x10 ⁻⁴	6x10 ⁻⁴	0°C	6h	No reduction
8x10 ⁻⁶	-	2.5x10 ⁻⁴	6x10 ⁻⁴	0°C	6h	No reduction
1.33x10 ⁻⁵	2.66x10 ⁻⁶	2.5x10 ⁻⁴	3x10 ⁻⁴	0°C	6h	Nanoparticle
						formation
1.33x10 ⁻⁵	2.66x10 ⁻⁶	5x10 ⁻⁴	3x10 ⁻⁴	0°C	6h	Nanoparticle
		4	4			formation
1.33x10 ⁻⁵	2.66x10 ⁻⁶	2.5x10 ⁻⁴	3x10 ⁻⁴	0°C	3h	NS and NP
1.33x10 ⁻⁵	2.66x10 ⁻⁶	5x10 ⁻⁴	3x10 ⁻⁴	0°C	3h	NS and NP
6.65x10 ⁻⁶	1.35x10 ⁻⁶	5x10 ⁻⁴	3x10 ⁻⁴	0°C	6h	NS and NP
6.65x10 ⁻⁶	1.35x10⁻ ⁶	2.5x10 ⁻⁴	3x10 ⁻⁴	0°C	6h	NS formation
6.65x10 ⁻⁶	1.35x10 ⁻⁶	2.5x10 ⁻⁴	3x10 ⁻⁴	0°C	3h	NS and NP
6.65x10 ⁻⁶	1.35x10 ⁻⁶	5x10 ⁻⁴	3x10 ⁻⁴	0°C	3h	NS and NP
1.33x10 ⁻⁵	2.66x10 ⁻⁶	2.5x10 ⁻⁴	6x10 ⁻⁴	0°C	6h	No reduction
6.65x10 ⁻⁶	1.35x10 ⁻⁶	2.5x10⁻⁴	6x10 ⁻⁴	0°C	6h	No reduction
7.28 x10 ⁻⁶	7.2 x10 ⁻⁷	2.5x10 ⁻⁴	3x10 ⁻⁴	0°C	6h	NS formation
1.456x10 ⁻⁵	1.44x10 ⁻⁶	5x10 ⁻⁴	3x10 ⁻⁴	0°C	6h	NS and NP
1.456x10⁻⁵	1.44x10 ⁻⁶	2.5x10 ⁻⁴	3x10 ⁻⁴	0°C	3h	NS and NP
1.456x10 ⁻⁵	1.44x10 ⁻⁶	5x10 ⁻⁴	3x10 ⁻⁴	0°C	3h	NS and NP
1.456x10 ⁻⁵	1.44x10 ⁻⁶	2.5x10 ⁻⁴	6x10 ⁻⁴	0°C	6h	No reduction
1.456x10 ⁻⁵	1.44x10⁻ ⁶	2.5x10 ⁻⁴	6x10 ⁻⁴	0°C	6h	No reduction
8x10 ⁻⁶	-	2.5x10 ⁻⁴	3x10 ⁻⁴	35°C	6h	No reduction
6.65x10 ⁻⁶	1.35x10 ⁻⁶	5x10 ⁻⁴	3x10 ⁻⁴	35°C	6h	No reduction
1.456x10 ⁻⁵	1.44x10 ⁻⁶	2.5x10 ⁻⁴	3x10 ⁻⁴	0°C	6h	No reduction

Table S1: Reaction parameters



Figure S4: TEM image of PdAu 2:1 NS's.



Figure S5: Survey scan of Pd NS, PdAu 5:1 NS and PdAu 10:1 NS with incomplete and complete reduction.



Figure S6: FTIR of the surfactant C_{22} -QA(Br⁻), Pd and PdAu nanosheets.

Catalyst	Surface Ligand	Reaction conditions	% Yield	Ref				
Conventional Suzuki Cross Coupling								
PdAu nanoflower	PVP	80°C, 15 min, 0.3 wt%	93 %	1				
Pd Nanocube	СТАВ	Room temperature, 30 min, 4 wt%,	95 %	2				
AuPd Nanoparticles	N/A	30 °C, 6 h, 3 wt%	96 %	3				
Pd NP-TiO ₂		28 °C, 4 h, 5 wt%	93 %	4				
Pd nanoparticles	PVA	60 °C, 30 min, 0.2 mol%	79 %	5				
	Light-driven Suzuki Cross Coupling							
PdAu NPs on ZrO ₂		45°C, 24h , Visible light	80 % light	6				
			10 % Dark					
Pd NP on 2H-WS ₂	PVP	RT, 3h, 60 W LED, 2.85 μg catalyst	90%	7				
Pd/ZnO		RT, 1.5 h, visible light	96 % Light	8				
			Trace Dark					
AuPd nanowheels		50 °C, 90 min, Xe lamp, 0.2 mg catalyst	100 % Light	9				
			18 % dark					
Pd hexagonal	PVP	25°C, 3 h, Xe lamp	90 %	10				
nanoplates		0.005 mmol catalyst loading						
Pd/Au nanosheets	C ₂₂ -QA	0°C, 6h, Visible light, 0.2 mol% catalyst	99%	This				
		loading		work				

Table S2: Summary of literature reports of catalysts used for Suzuki cross coupling under conventional(thermal) and light driven catalysis.

While it can be difficult to make direct comparison on catalytic performance, due to different reaction

conditions (catalyst loading, time, temperature, light source), Table 1 is nevertheless useful.



Figure S7: NMR of 4-methoxybiphenyl from the Suzuki cross couple reaction.



4-methoxybiphenyl: white solid, ¹H NMR (300 MHz CDCl₃)

 δ = 7.56-7.55 (m, 4H), 7.41 (t, J=7.35Hz, 1H), 6.99 (d, J=8.8 Hz, 2H), 3.85 (s, 3H) ppm all in agreement with literature reports.

Catalyst	mol %	°C	Time	% Conversion	TON ^(a)	TOF(h ⁻¹) ^(b)
Pd Dark	0.1	25	2 h	0	0	0
Pd LED	0.1	25	2h	10	100	50
Pd Dark	0.2	25	2h	11	55	27.5
Pd LED	0.2	25	2h	10	50	25
PdAu Dark	0.1	25	2h	48	480	240
PdAu LED	0.1	25	2h	58	580	240
PdAu Dark	0.2	25	2h	36	180	90
PdAu LED	0.2	25	2h	93	465	232.5

Table S3: TOF for Pd and PdAu catalysts in the dark and under LED light at 0.1 and 0.2 mol% where $^{(a)}$ TON= moles of product x conversion/moles of Pd) and $^{(b)}$ TOF= TON/time (h)



Figure S8: TEM images of CO-assisted Pd/Au nanosheets



Figure S9: (a)TEM image and (b) EDX line scan of PdAg NS.

The CO-assisted methodology was successful for PdAg NSs. Supporting information, Figure S9 (a) shows a TEM image of PdAg NSs with a well-defined morphology and a mean length of 24 nm. shows a single PdAg NS and alloy formation was confirmed by EDX analysis, as displayed in Figure 9 (b), showing a homogenous distribution of Pd and Ag across the NS.



Figure S10: TEM images of nanosheets which were destroyed by chemically cleaned using NaBH_4



Figure S11: Size distribution profile of Pd NS with chain lengths (a) C8, (b) C12, (c) C16 and (d) C22

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