Electronic Supplementary Information (ESI)

Controlled deposition of palladium nanodendrites on tips of gold nanorods and their enhanced catalytic activity†

Gaoxing Su,*[ab] Huaqiao Jiang,[ab] Hongyan Zhu,[b] Jing-Jing Lv,[a] Guohai Yang,[a] Bing Yan*[c] and Jun-Jie Zhu*[a]

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[a]*State Key Laboratory of Analytical Chemistry for Life Science, School of Chemistry and Chemical Engineering, Nanjing University, Nanjing 210093, P. R. China. E-mail: jjzhu@nju.edu.cn*

[b]*School of Pharmacy, Nantong University, Nantong 226001, P. R. China. E-mail: sugaoxing@ntu.edu.cn*

[c]*School of Environmental Science and Engineering, Shandong University, Jinan 250100, P. R. China. E-mail: drbingyan@yahoo.com*

Synthesis of AuNR-2[1]: CTAB (9.8 mL, 0.1 M) was added to 0.20 mL of 0.0040 M $AgNO_3$ solution. To this solution, 0.5 mL of 10 mM $HAuCl_4$ was added, and after gentle mixing of the solution 70 μL of 0.0788 M ascorbic acid was added. The final step was the addition of 12 μL of the seed solution to the growth solution at 25 °C. The mixture was kept quietly for 12 h. After centrifugation and washing twice, AuNR-2 was obtained.

Synthesis of AuNR-3[2]: The seed solution was prepared mixing 0.6 mL of fresh prepared 0.01 M NaBH4 with 5 mL of 0.5 mM $HAuCl_4$ and 5 mL of 0.2 M CTAB solution. The seed solution was aged at room temperature for 30 min after 2 min stir. To prepare the growth solution, 4.5 g of CTAB and 0.617 g of sodium oleate were dissolved in 125 mL water at 50 °C. Then 12 mL of 4 mM $AgNO_3$ was added after the solution was cooled down to 30 °C. The solution was then kept undisturbed for 15 min, and after that 125 mL of 1 mM HAuCl4 was added. 1 mL of concentrated HCl was added after 90 min of genteel stirring. After 15 min, 625 μL of 0.064 M ascorbic acid was added and stirred for 30 s. At last, 150 μL of seed solution was added and further stirred for 30 s. The solution was kept at 30 °C for 12 h and then centrifuged and washed with water once. The obtained AuNR-3 were finally dispersed in 20 mL of water.

Reference:

(1) Nikoobakht, B.; El-Sayed, M. A.: Preparation and growth mechanism of gold nanorods (NRs) using seed-mediated growth method. *Chemistry of Materials* **2003**, *15*, 1957-1962.

(2) Ye, X.; Zheng, C.; Chen, J.; Gao, Y.; Murray, C. B.: Using binary surfactant mixtures to simultaneously improve the dimensional tunability and monodispersity in the seeded growth of gold nanorods. *Nano letters* **2013**, *13*, 765-771.

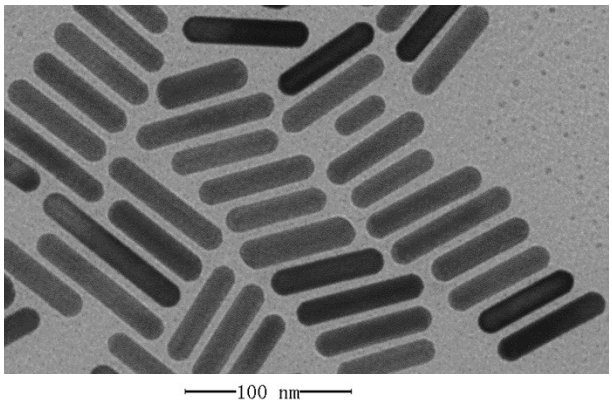


Fig. S1. TEM image of AuNR-1.

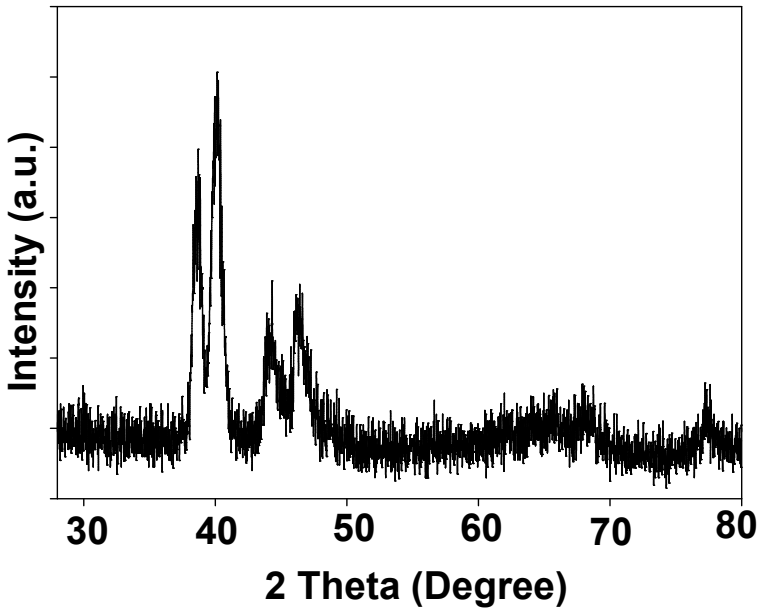


Fig. S2. XRD pattern of as-synthesized PdND-T-AuNRs. H_2PdCl_4 solution (26 μL, 10 mM) and AA (13 μL, 0.1 M) were added nine times sequentially into CTAC solution at room temperature.

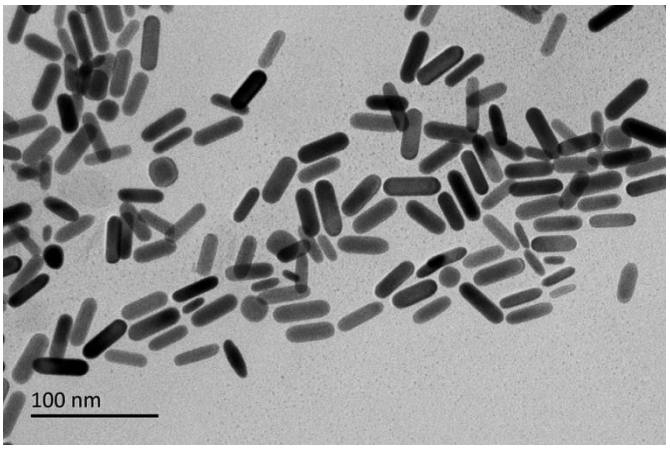


Fig. S3. TEM image of AuNR-2.

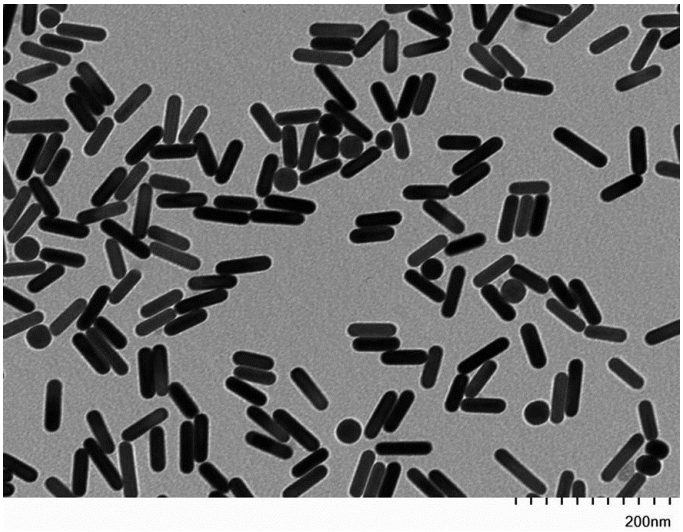


Fig. S4. TEM image of AuNR-3.

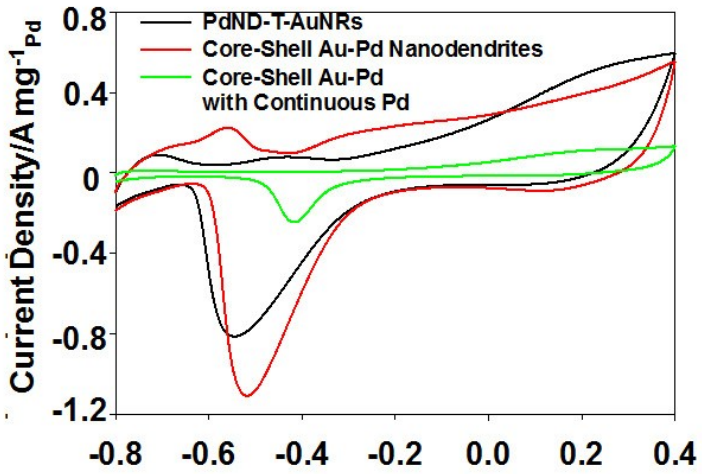


Fig. S5. CVs of PdND-T-AuNRs (black line), core-shell Au-Pd nanodendrites (red line), and core-shell Au-Pd nanocrystals with continuous palladium layer (green line) at 50 mV s^{-1} in 1.0 M KOH.

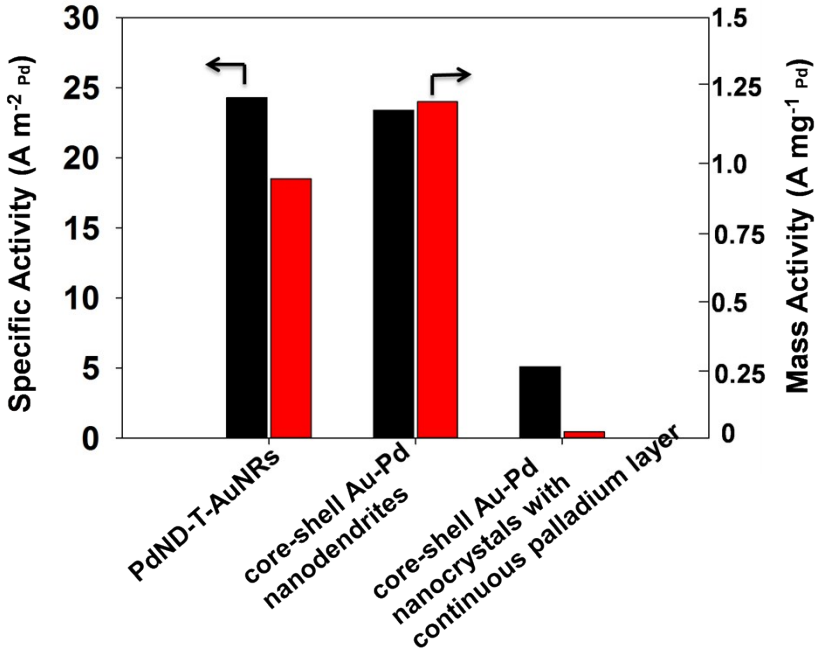
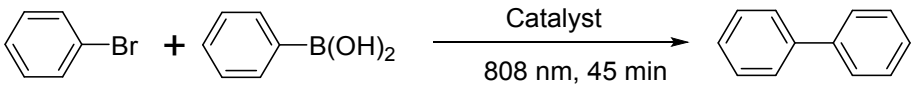


Fig. S6. Comparison of specific activity and mass acitivity of three different catalysts for ethanol electrooxidation at -0.11 V.

Table S1. Yields and TOFs of Suzuki coupling reactions catalyzed by PdND-T-AuNRs[a]

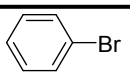
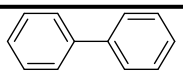
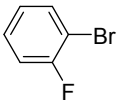
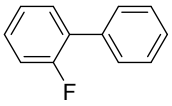
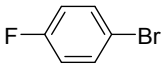
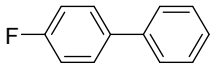
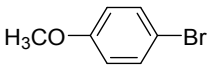
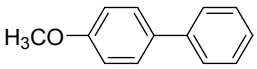
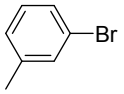
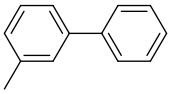
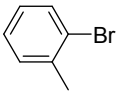
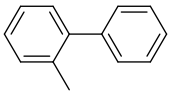
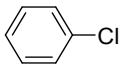
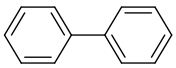
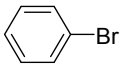
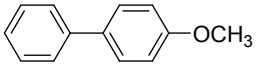
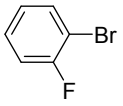
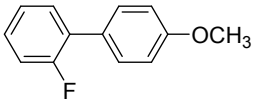
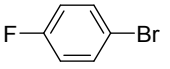
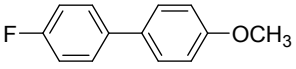
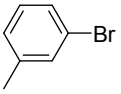
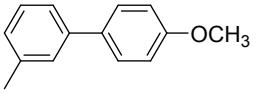


Entry	Catalysts	Pd Amounts[b] (mmol)	Au:Pd[b]	Yields (%)	TOF (h^{-1})
1	AuNRs	0	0	Trace	0
2	PdND-T-AuNR-1	3.5×10^{-5}	1:0.64	12	457
3	PdND-T-AuNR-2	7.3×10^{-5}	1:1.3	32	584
4	PdND-T-AuNR-3	1.1×10^{-4}	1:2.0	65	788
5	PdND-T-AuNR-6	2.9×10^{-4}	1:5.3	99	455
6	PdND-T-AuNR-9	3.8×10^{-4}	1:7.0	99	347

[a]Reaction conditions: bromobenzene (10.5 μL, 0.1 mmol), phenylboronic acid (13.6 mg, 0.1 mmol), NaOH (12 mg, 0.3 mmol), CTAB (18.4 mg, 0.05 mmol), catalysts (0.2 mL) with constant gold content. H_2O (1.8 mL). 808 nm laser (0.6 W/cm^{-2}), room temperature, 45 min.

[b]Determined by ICP-OES.

Table S2. Conversion and selectivity of Suzuki coupling reactions of benzyl halides and phenylboronic acid with different substitutes[a]

Entry	Aryl Halides	Coupling Product	Conversion (%)	Selectivity (%)
1			100	99
2			78	82
3			100	99
4			53	93
5			100	86
6			99	94
7			17	100
8			92	96
9			100	99
10			100	98
11			100	99

[a]Reaction conditions: aryl halides (0.1 mmol), substituted phenylboronic acids (0.1 mmol), NaOH (12 mg, 0.3 mmol), CTAB (18.4 mg, 0.05 mmol), PdND-T-AuNRs (0.2 mL, containing 2.9×10^{-4} mmol of palladium). H_2O (1.8 mL). 808 nm laser (0.6 W/cm^{-2}), room temperature, 45 min.