**Supporting information**

**Architecture engineering of one body nanostructured catalyst: layer-by-layer adornment of multiple nanocatalysts on silica nanorod arrays for hydrogenation of nitroarenes**

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**Heterogeneous reduction of substituted nitroarenes**

The reduction of nitroarenes was performed in a glass flask. In a typical procedure, v-SiO2 NRs@Pd nanostructured catalyst (1 mol%) was immersed in H2O (20 mL). Then, a nitroarenes compound (0.1 mmol), NaBH4 (0.12 mol%) and a small stirring bar were added to the glass flask. The reaction mixture was stirred at room temperature for 1.5 h under air atmosphere. After completion of the reaction, the v-SiO2 NRs@Pd nanostructured catalyst was drawn out from the reaction mixture by tweezers, rinsed with ethanol, and reused in the next cycle.

**Heterogeneous Suzuki cross-coupling reactions**

Suzuki reactions were expedited using v-SiO2 NRs@Pd nanostructured catalyst in a round-bottom flask containing dimethylformamide (DMF)/H2O (5:1) solvent. Aryl halide (0.1 mmol), phenylboronic acid (0.12 eq.), K2CO3 (1.5 eq.), and a small stirring bar were added to the flask immersed in an oil bath (100 °C). The reaction mixtures were stirred under air atmosphere for adequate time to obtain the expected biphenyl products.

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**Fig. S1.** XPS analysis of (a) survey, (b) Si, and (c) O present in v-SiO2 NRs@Pd

nanostructured catalyst.

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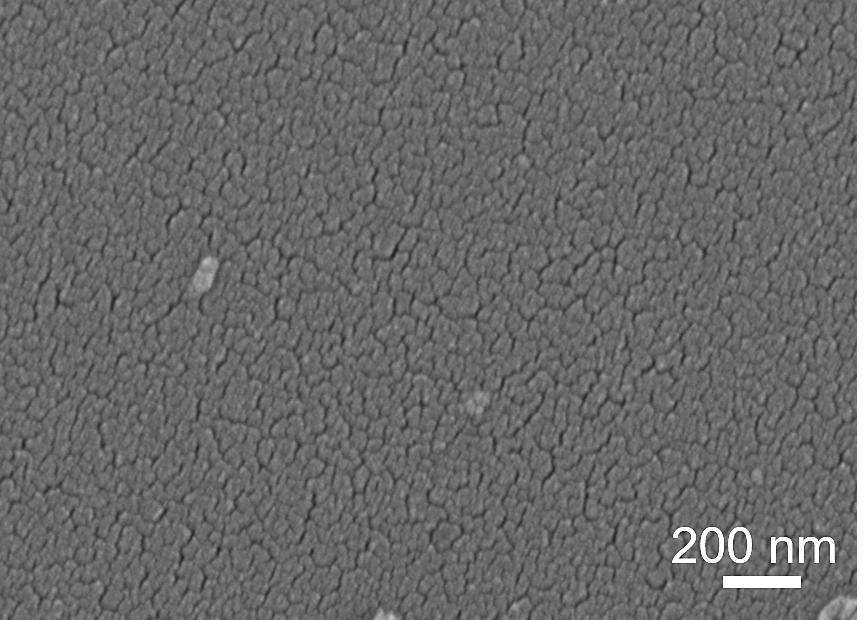
**Fig. S2.** (a) Cross-sectional FESEM image of v-SiO2 NRs@Pd/Au nanostructured catalyst. (b-e) EDS element maps of (b) Si, (c) O, (d) Au, and (e) Pd of v-SiO2 NRs@Pd/Au nanostructured catalyst. HRTEM images of (f) Au and (g) Pd existing in v-SiO2 NRs@Pd/Au nanostructured catalyst. XPS analysis of (h) Au and (i) Pd in v-SiO2 NRs@Pd/Au nanostructured catalyst.



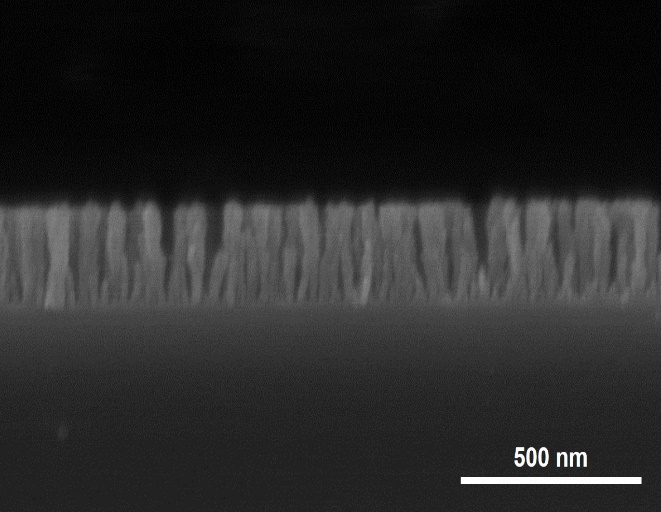
**Fig. S3.** Cross-sectional FESEM image of v-SnO2 NRs@Pd nanostructured catalyst.



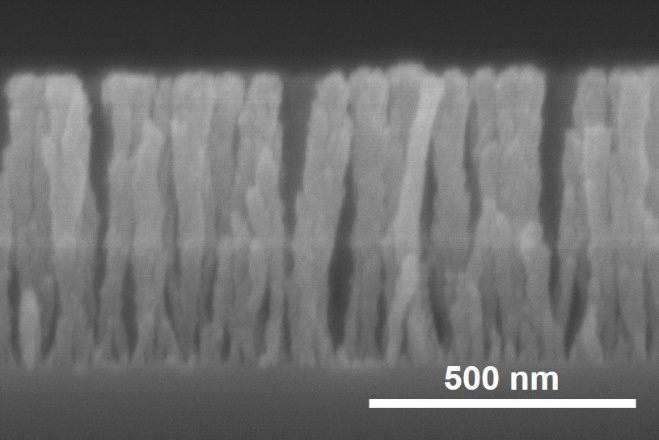
**Fig. S4.** C-13 NMR spectrum of 3-vinylbenzenamine (Table 1, entry).

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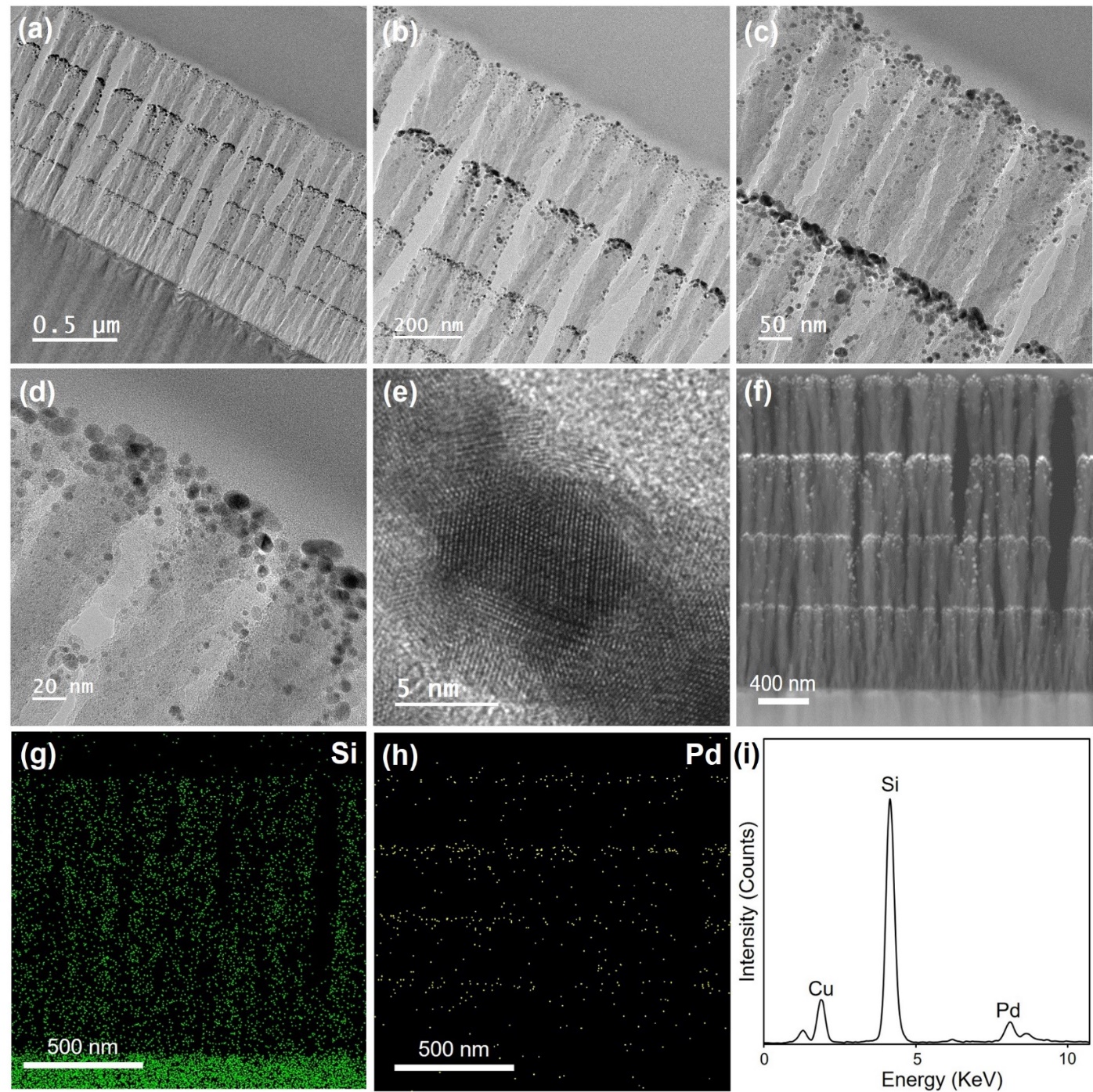
**Fig. S5.** FESEM image of Pd NPs deposited directly on silicon wafer.

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**Fig. S6.** Cross-sectional FESEM image of ~200 nm v-SiO2 NRs@Pd nanostructured catalyst.



**Fig. S7.** Cross-sectional FESEM image of ~600 nm v-SiO2 NRs@Pd nanostructured catalyst.



**Fig. S8.** (a-e) Cross-sectional TEM and HRTEM images, and (F) STEM image of recycled v-SiO2 NRs@Pd nanostructured catalyst. (g) Si, and (h) Pd elemental mapping of recycled v-SiO2 NRs@Pd nanostructured catalyst. (i) EDX spectrum of recycled v-SiO2 NRs@Pd nanostructured catalyst.

**Table S1.** Heterogeneous reduction of nitrobenzene catalyzed by different nanostructured catalyst.

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| --- | --- | --- | --- |
| **Entry** | **Nanostructured catalyst** | **Yields (%)a** |  |
| 1 | Pd NPs on silicon wafer | 15 |  |
| 2 | Pd NPs on ~200 nm SiO2 NRs | 35 |  |
| 3 | Pd NPs on ~600 nm SiO2 NRs | 58 |  |
| 4 | v-SiO2 NRs@Pd catalyst | 99 |  |

Reaction conditions: Nitrobenzene (0.1 mmol), NaBH4 (0.12 mmol), nanostructured catalyst (1 mol% Pd), H2O (20 mL), room temperature, and 1.5 h. a Yields were determined by GC-MS.