

## Electronic Supplementary Information

### Synthesis of Pd Nanorod Arrays on Au Nanoframes for Excellent Ethanol Electrooxidation

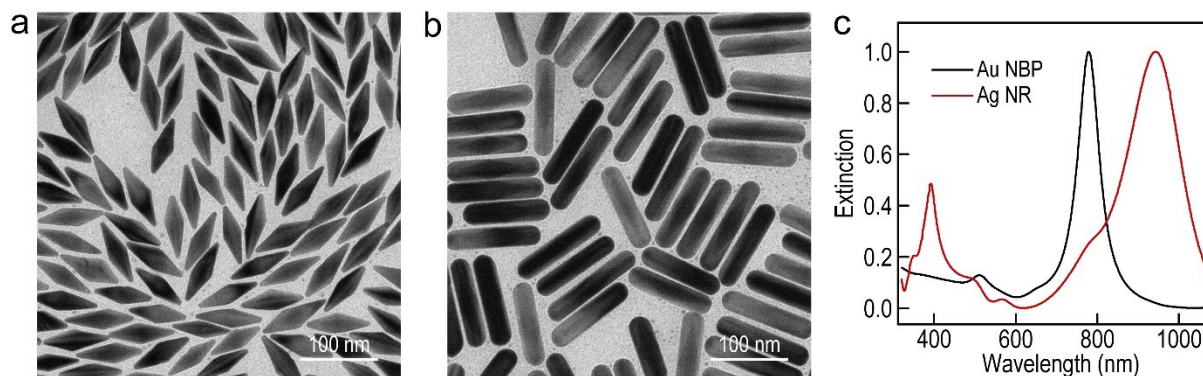
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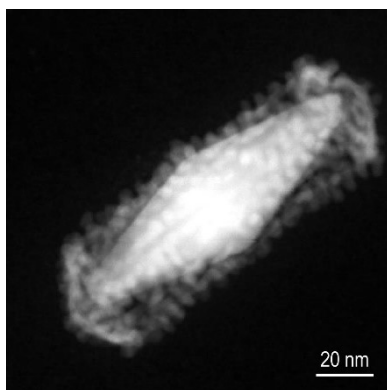
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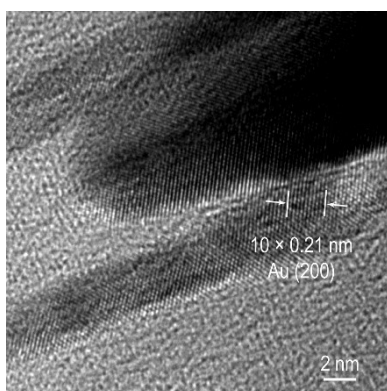
#### Supplementary figures



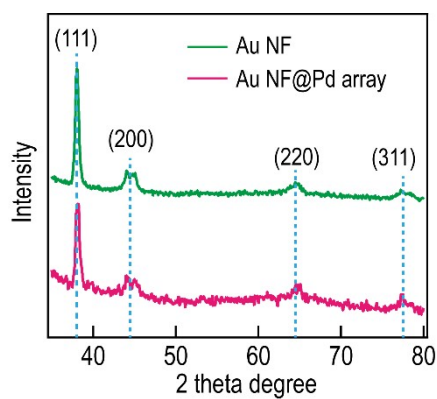
**Fig. S1** (a) TEM image of Au NBPs with average waist width of  $26 \pm 2$  nm and length of  $83 \pm 3$  nm. (b) TEM image of the Au NBP@Ag nanorods with average diameter of  $27 \pm 2$  nm and length of  $121 \pm 4$  nm. (c) Extinction spectra of Au NBPs and Au NBP@Ag nanorods.



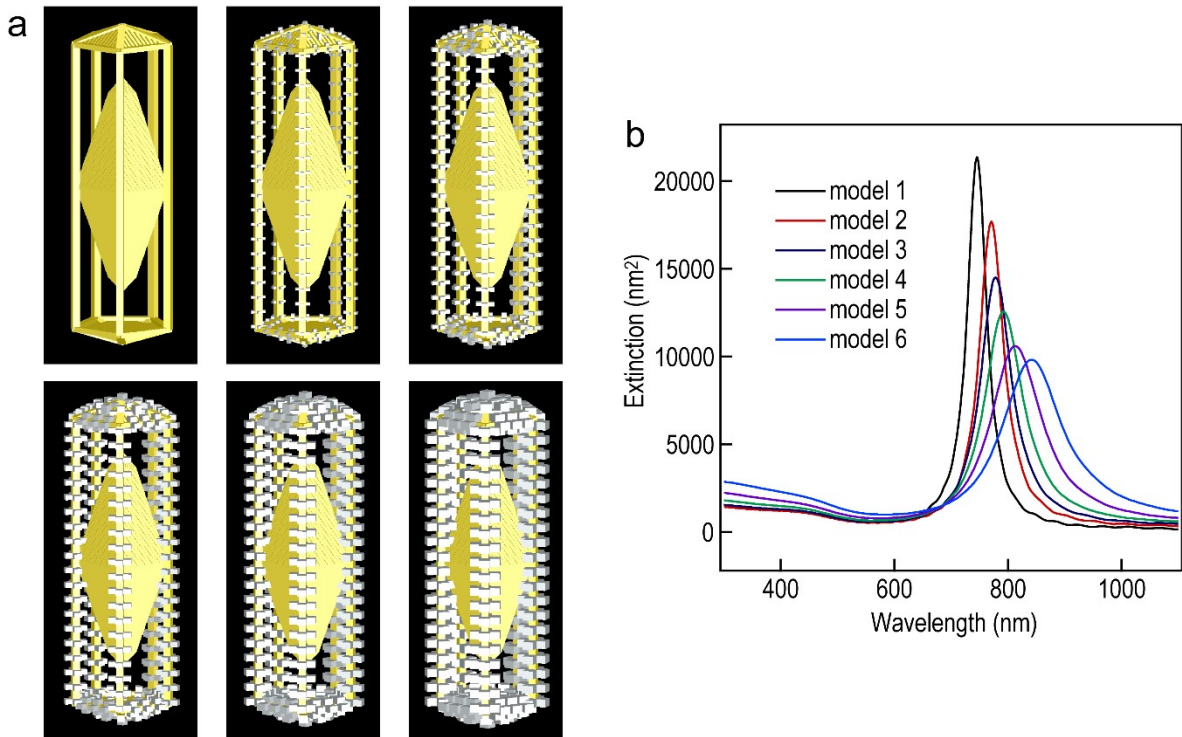
**Fig. S2** The HAADF-STEM image of a single Au NF@Pd array.



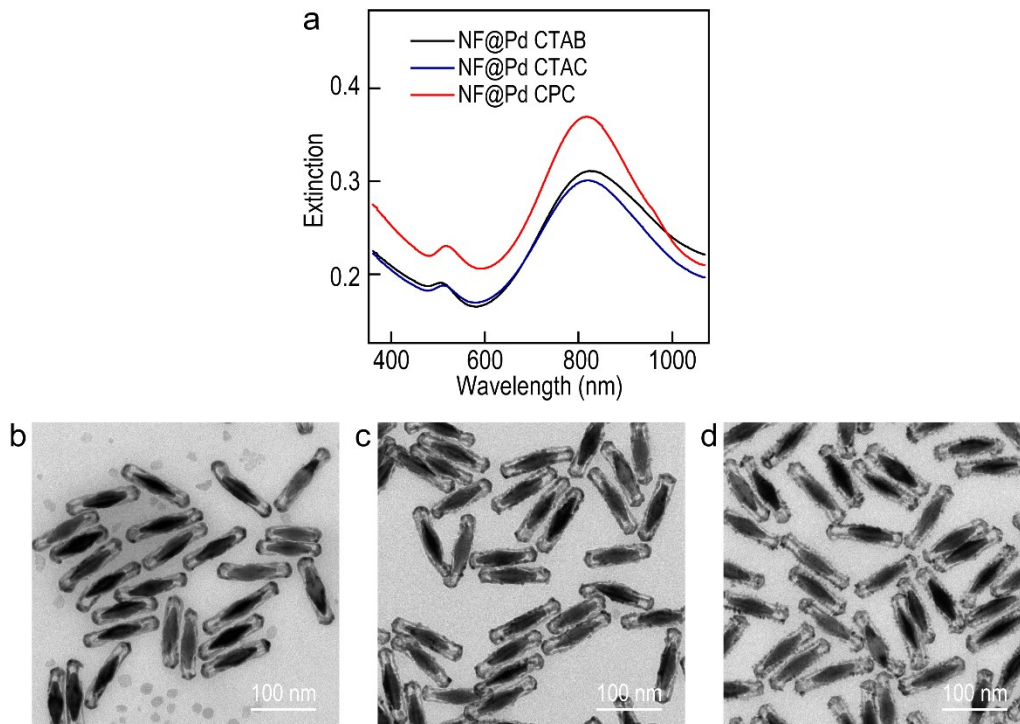
**Fig. S3** HRTEM image of a single Au NBP-embedded Au NF.



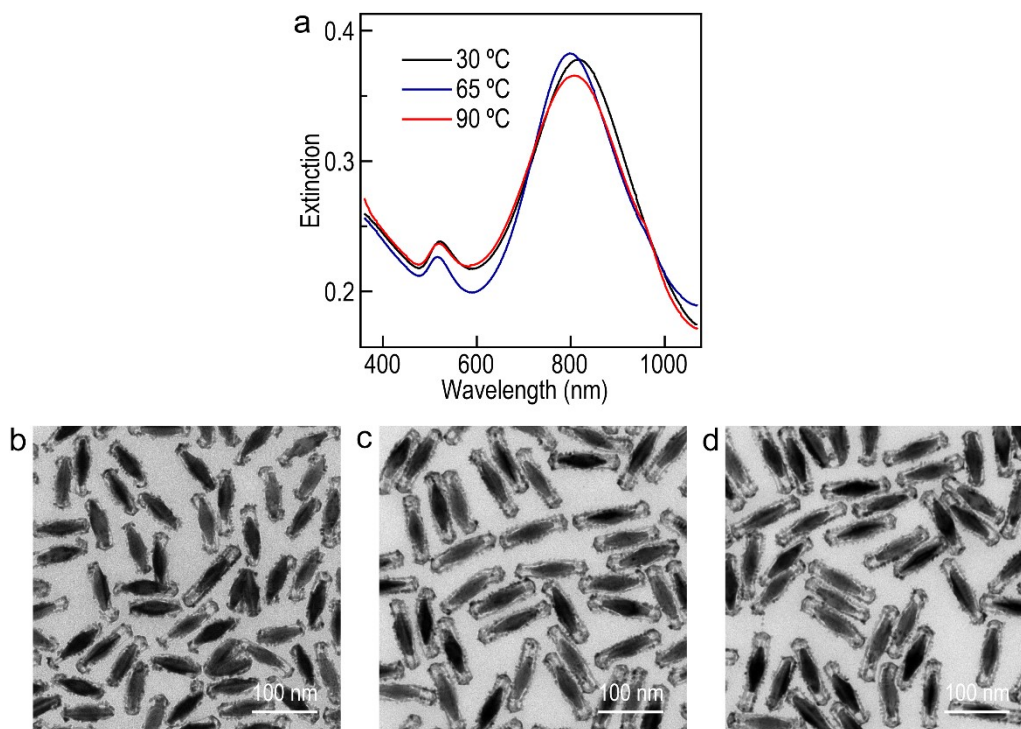
**Fig. S4** XRD patterns of the Au NFs and Au NF@Pd arrays, respectively.



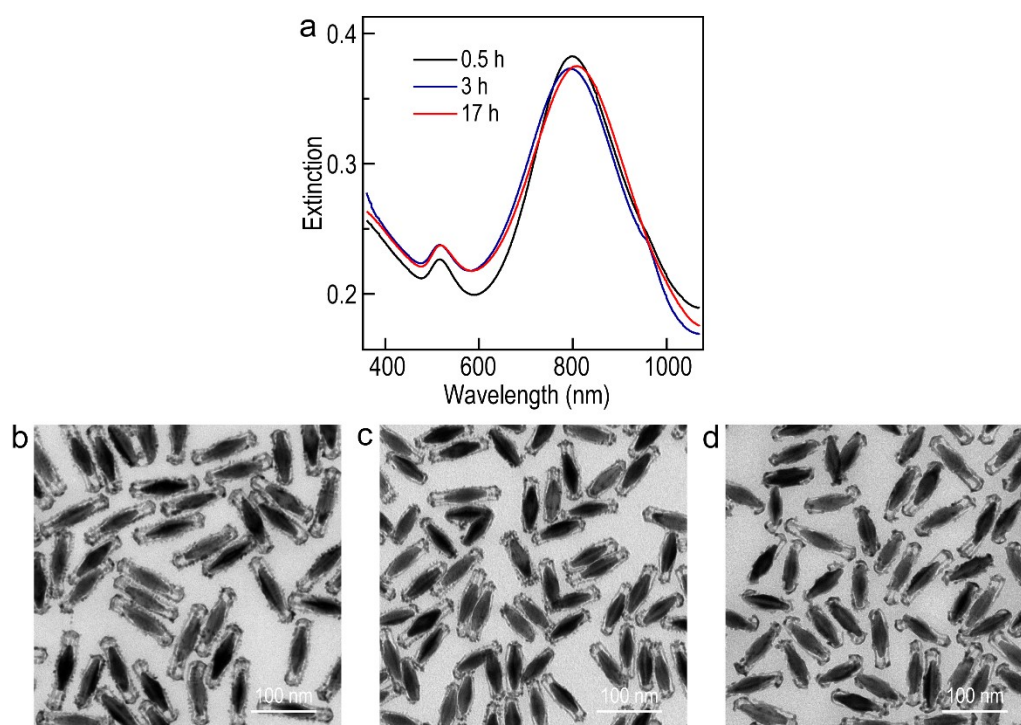
**Fig. S5** FDTD simulations with Pd arrays only deposited on the outside Au NFs. The longitudinal dipolar plasmon wavelength of the starting Au NBP@Au nanoframe is 745 nm. (a) Schematic models utilized in the simulations. (b) Simulated extinction spectra for the nanostructure.



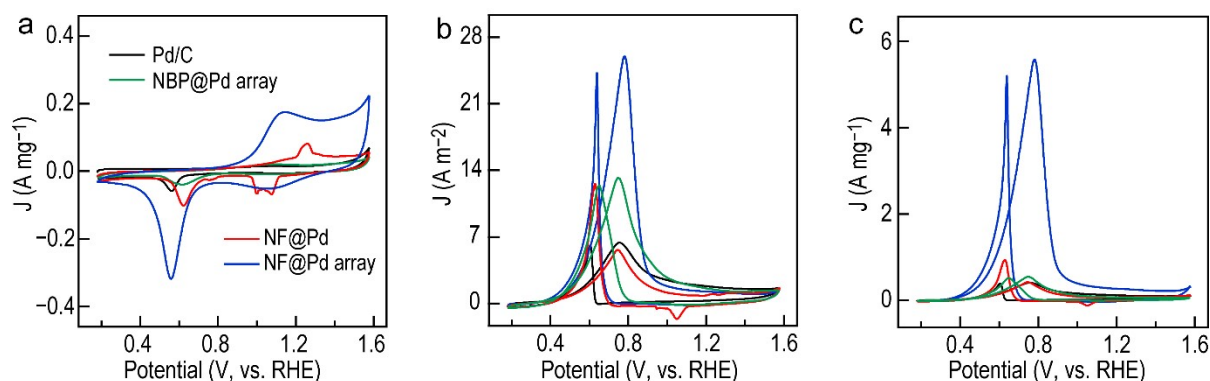
**Fig. S6** (a) Extinction spectra of Au NF@Pd nanostructures synthesized with different surfactants. (b–d) TEM images of Au NF@Pd nanostructures synthesized with CTAB, CTAC and CPC, respectively.



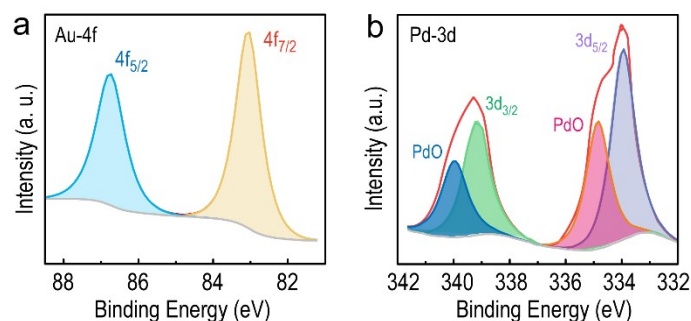
**Fig. S7** (a) Extinction spectra of Au NF@Pd arrays synthesized at different temperatures. (b–d) TEM images of Au NF@Pd arrays synthesized at 30 °C, 65 °C and 90 °C, respectively.



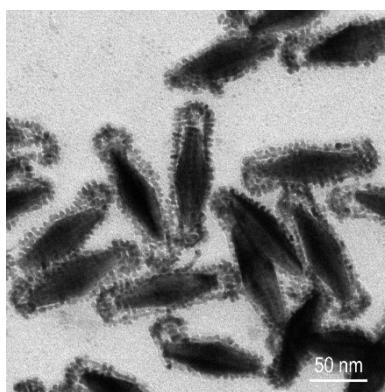
**Fig. S8** (a) Extinction spectra of Au NF@Pd arrays with different reaction times. (b–d) TEM images of Au NF@Pd arrays synthesized at 0.5 h, 3 h and 17 h, respectively.



**Fig. S9** CV curves of commercial Pd/C, Au NBP@Pd array, Au NF@Pd and Au NF@Pd array in a N<sub>2</sub>-saturated (a) aqueous KOH and (b,c) mixture of ethanol and KOH, respectively. The currents shown in (a,c) and (b) are normalized by the Pd mass loaded and the ECSA values, respectively.



**Fig. S10** (a) Au 4f and (b) Pd 3d XPS spectra for the Au NF@Pd arrays after electrocatalysis.



**Fig. S11** TEM image of the Au NF@Pd arrays after CA measurement. The sample was collected by ultrasonicated the working electrode after CA test.

## Supplementary tables

**Table S1** The contents of Au, Pd, and Ag elements in different Au-Pd catalysts before and after the electrocatalysis.

	Au ( $\mu\text{g}$ )		Pd ( $\mu\text{g}$ )		Ag ( $\mu\text{g}$ )	
	before	after	before	after	before	after
Au NBP@Pd array	1.018	0.87	0.278	0.227	0.0496	0.0433
Au NF@Pd	1.063	0.914	0.305	0.232	0.1634	0.1355
Au NF@Pd array	1.232	0.974	0.3	0.262	0.1637	0.1357