## **Electronic supplementary information**

## (Gold Nanorod Core)/(Poly(3,4-ethylene-dioxythiophene) Shell)

## Nanostructures and Their Monolayer Arrays for Plasmonic Switching

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**Fig. S1** Effects of HCl concentration and the  $K_2S_2O_8$  to EDOT ratio on coating of PEDOT on Au nanorods. (a) Absorption spectra of the pure PEDOT synthesized by using HCl with varying molar concentrations. (b) Extinction spectra of the Au nanorods coated by PEDOT prepared at different HCl concentrations. (c) Absorption spectra of the pure PEDOT synthesized by using different molar ratios of  $K_2S_2O_8$  to EDOT monomer.



**Fig. S2** (a,b) TEM images of PEDOT-coated Au nanobipyramids (a) and nanospheres (b). (c) Extinction spectra of the Au nanospheres (NSs) and nanobipyramids (NBPs) before and after PEDOT coating.



Fig. S3 (a-f) TEM images of NR@PEDOT 1-6. (g) Extinction spectra of Au NR 1-6.



Fig. S4 Real parts of the dielectric function of PEDOT at doped and undoped states.



**Fig. S5** (a–f) Single-nanostructure scattering spectra of NR@PEDOT 1–6 at doped and undoped states of PEDOT. (g) Plasmon peak shifts of the NR@PEDOT 1–6 obtained from the scattering spectra.



**Fig. S6** Extinction spectra of the NR@PEDOT 2 solution at the undoped and doped states of PEDOT in two cycles. The dedoping was achieved by adding the two dedopants (NaOH and AA) while the doping was achieved by adding the two dopants (HCl and KMnO<sub>4</sub>), as we have introduced in the "Experimental" section in the main text.



**Fig. S7** (a,b) Scanning electron microscopy (SEM) image of the ITO substrates subjected to the electrophoretic deposition of the NR@PEDOT 2 at the voltages of 3 V (a) and 4 V (b).



Fig. S8 Extinction spectra of the NR@PEDOT 2 monolayer sample with a surface number density of ~18  $\mu$ m<sup>-2</sup> dedoped by AA (a) and NaOH (b) solution with different concentrations.



Fig. S9 Extinction spectra of the NR@PEDOT 2 monolayer sample with a surface number density of ~18 per  $\mu$ m<sup>2</sup> before and after being dedoped by AA or/and NaOH.



Fig. S10 (a,b) SEM image of the NR@PEDOT 2 monolayer array samples with the surface number density of ~11 per  $\mu$ m<sup>2</sup> and ~28 per  $\mu$ m<sup>2</sup>. (c,d) Extinction spectra of the NR@PEDOT 2 monolayer array samples shown in (a) and (b) at doped and undoped states of PEDOT.

Au NR	Length (nm)	Diameter (nm)	Aspect ratio	Longitudinal plasmon wavelength (nm)
1	$97.9\pm4.6$	53.1±1.9	1.86	635
2	$98.9\pm4.4$	$45.5\pm2.3$	2.10	650
3	$99.1\pm 6.1$	$43.5\pm2.6$	2.05	665
4	$100.8\pm4.2$	$44.0\pm2.3$	2.29	680
5	$102.7\pm5.5$	$44.9\pm2.6$	2.37	690
6	$119.1\pm9.3$	$47.9\pm4.1$	2.48	720

**Table S1** Average particle sizes and plasmon wavelengths of Au NR 1–6.