

Supporting Information

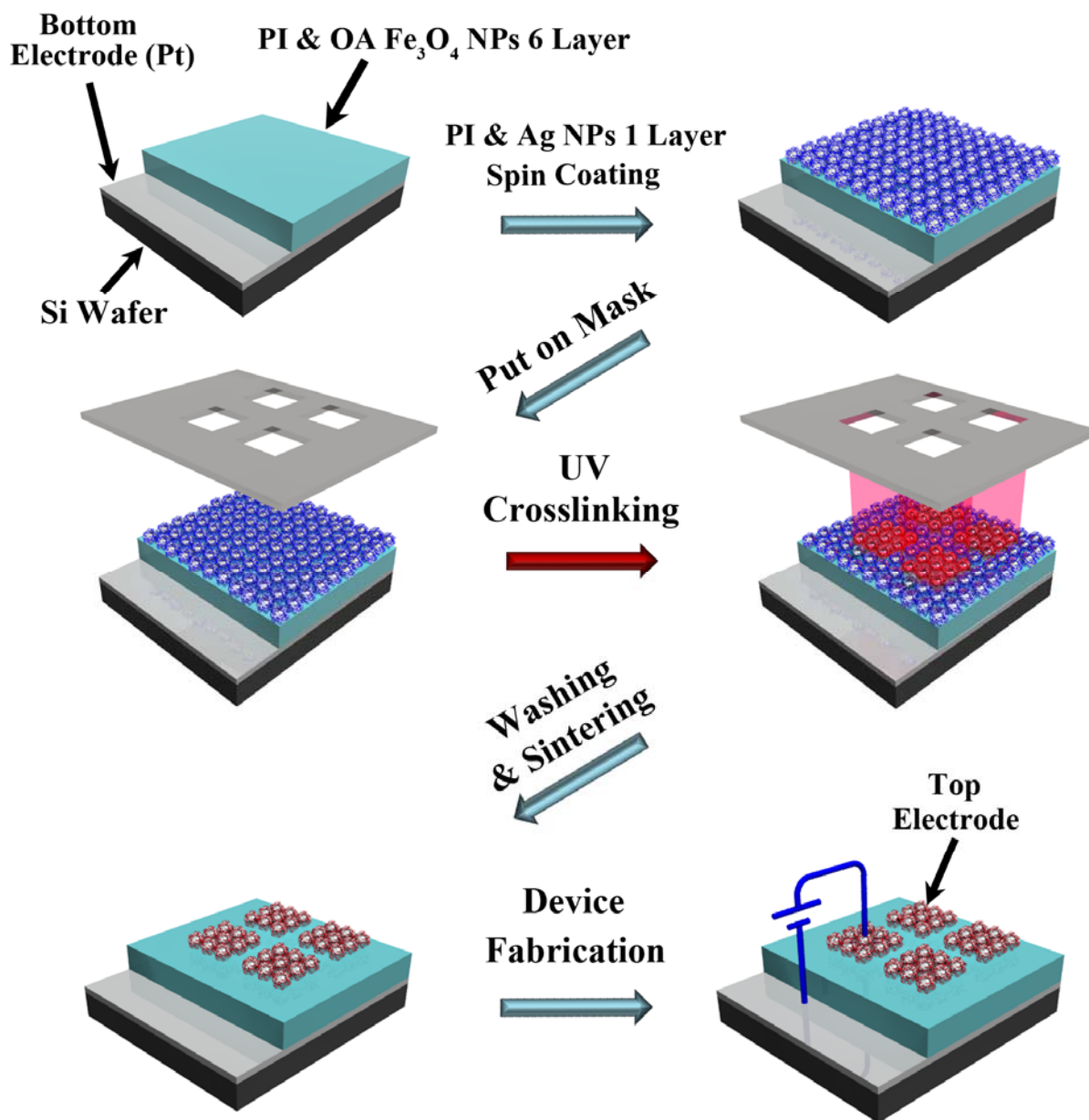
Inorganic Nanoparticle Multilayers Using Photo-Crosslinking Layer-by-Layer Assembly and Their Applications to Nonvolatile Memory Devices

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(Unit: nm)

OA-Fe ₃ O ₄ concentration	500 rpm	1000 rpm	1500 rpm	2000 rpm	3000 rpm	4000 rpm
5 mg · mL⁻¹	32 ± 3.1	24 ± 2.8	21 ± 1.5	21 ± 1.2	21 ± 0.94	20 ± 1.3
10 mg · mL⁻¹	34 ± 2.8	28 ± 1.9	24 ± 1.4	22 ± 0.79	22 ± 0.68	21 ± 0.71
15 mg · mL⁻¹	49 ± 1.8	35 ± 1.5	29 ± 1.4	27 ± 1.7	26 ± 2.1	25 ± 1.3
20 mg · mL⁻¹	56 ± 3.1	44 ± 2.7	33 ± 2.6	32 ± 1.4	32 ± 1.8	32 ± 2.9
30 mg · mL⁻¹	81 ± 3.9	75 ± 3.4	59 ± 2.7	52 ± 3.5	42 ± 3.1	42 ± 2.9

Table S1. Thickness data of the single-step spin-coated film with photo-crosslinking reaction as a function of concentration of Fe₃O₄ NP solution and spinning speed.



Scheme S1. Schematic representation of memory cell device with patterned Ag NP electrode through spin coating and photo-crosslinking of solution mixture of OA-Ag NP and PI.

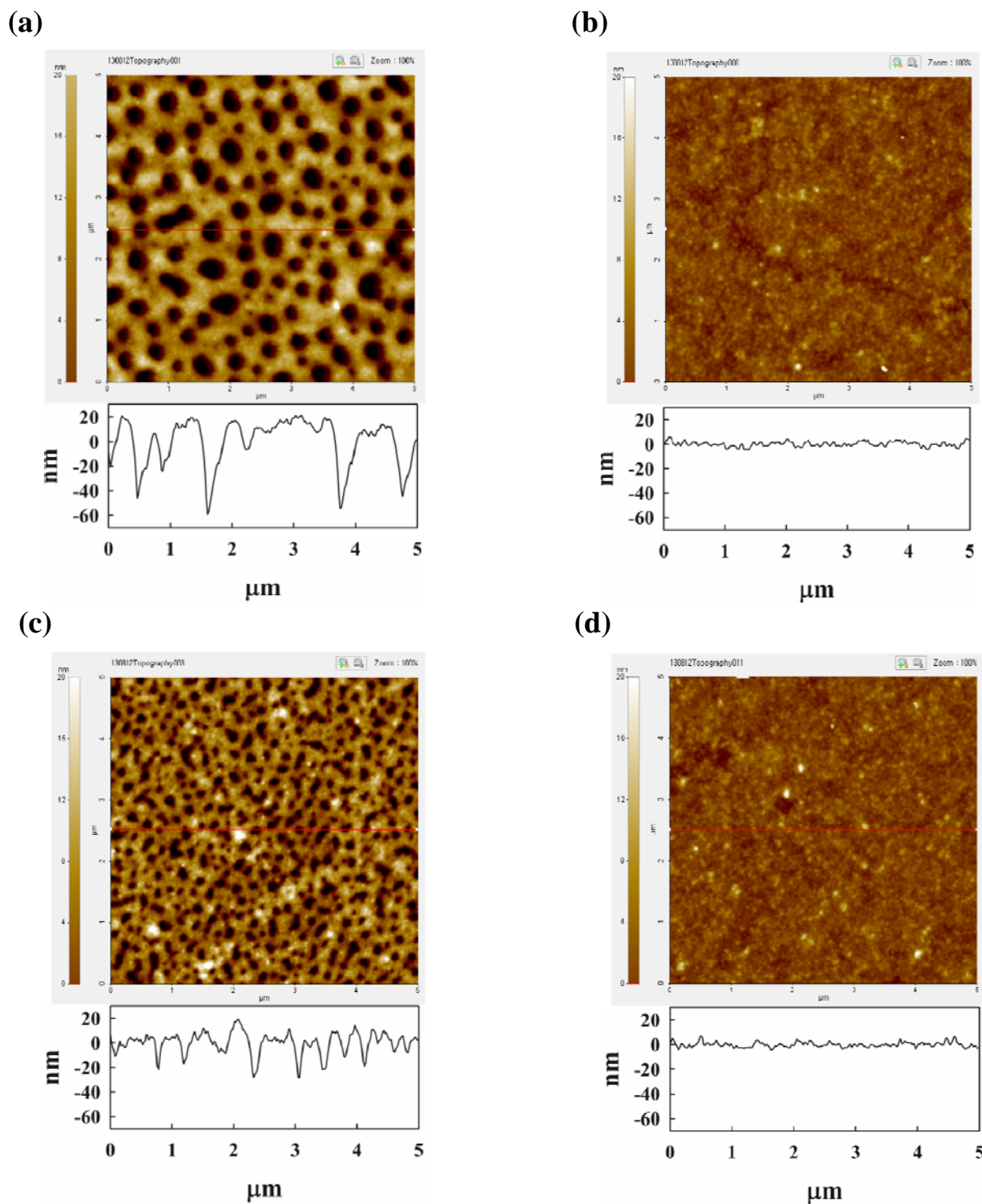
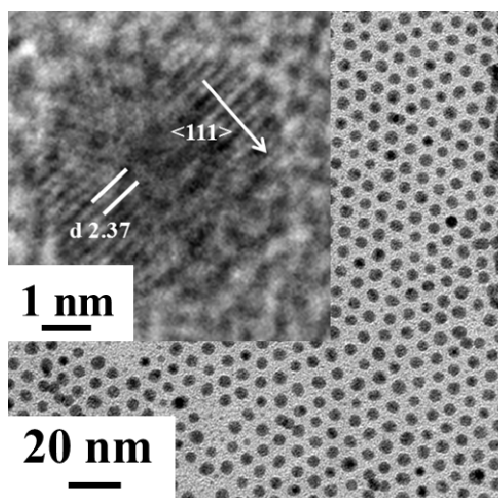
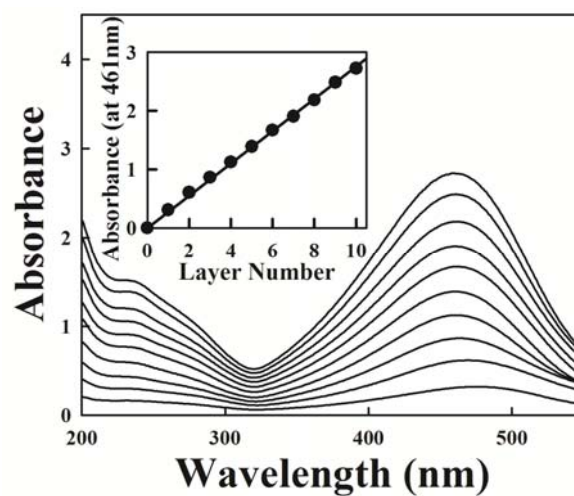


Figure S1. AFM topograph image and line profile of photo-crosslinked Fe_3O_4 NP film surface (a) $(\text{OA-Fe}_3\text{O}_4 \text{ NP})_1$ with 500 rpm and $30 \text{ mg} \cdot \text{mL}^{-1}$, (b) $(\text{OA-Fe}_3\text{O}_4 \text{ NP})_8$ with 3000 rpm and $5 \text{ mg} \cdot \text{mL}^{-1}$, (c) $(\text{OA-Fe}_3\text{O}_4 \text{ NP})_1$ with 3000 rpm and $30 \text{ mg} \cdot \text{mL}^{-1}$, (d) $(\text{OA-Fe}_3\text{O}_4 \text{ NP})_4$ with 3000 rpm and $5 \text{ mg} \cdot \text{mL}^{-1}$

(a)



(b)



(c)

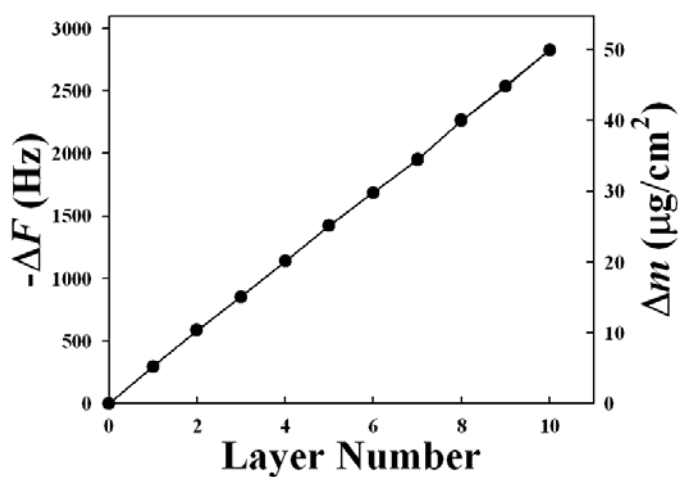


Figure S2. HR-TEM images, UV-vis spectra, and QCM data of 7 nm sized-OA-Ag

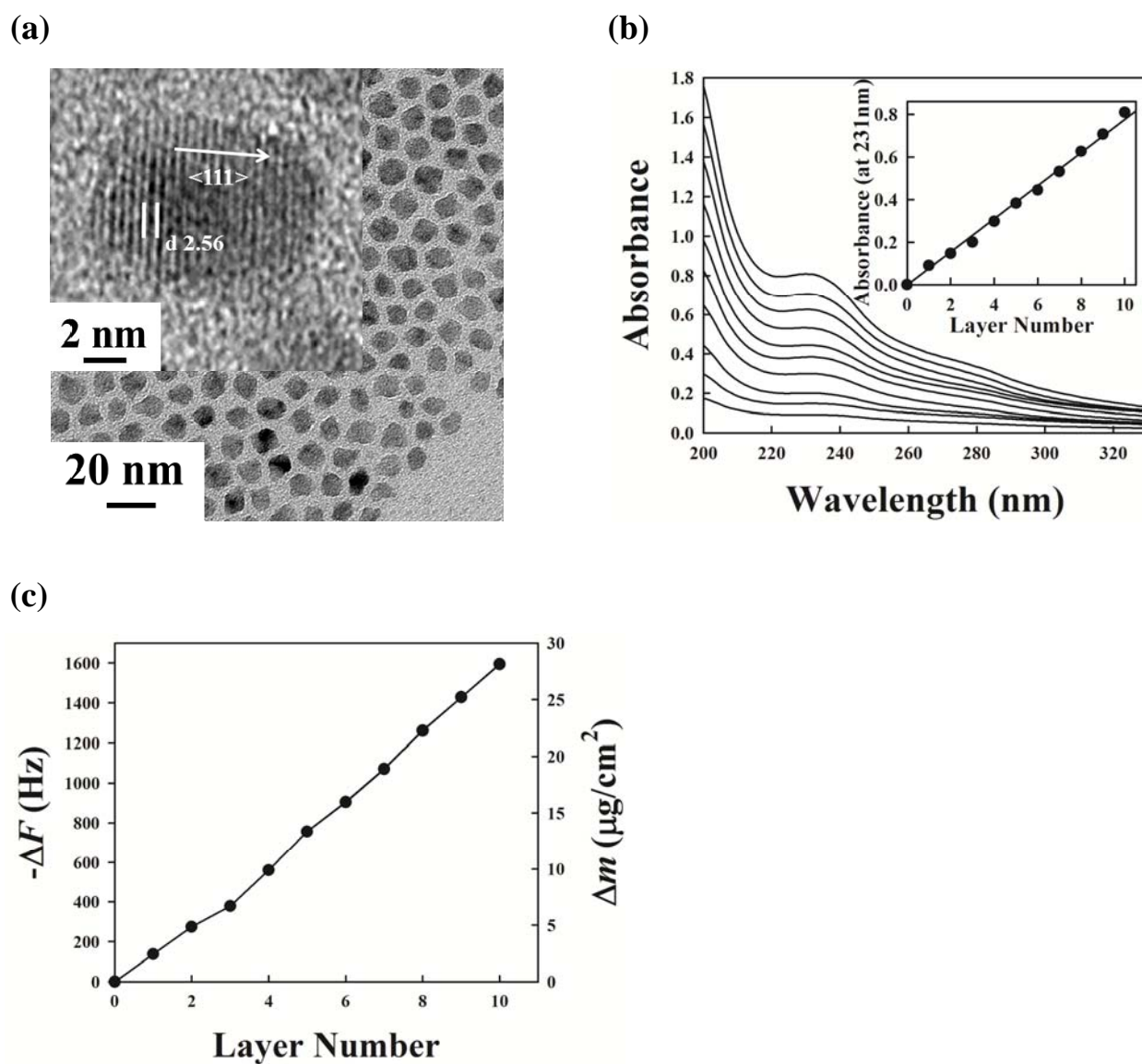
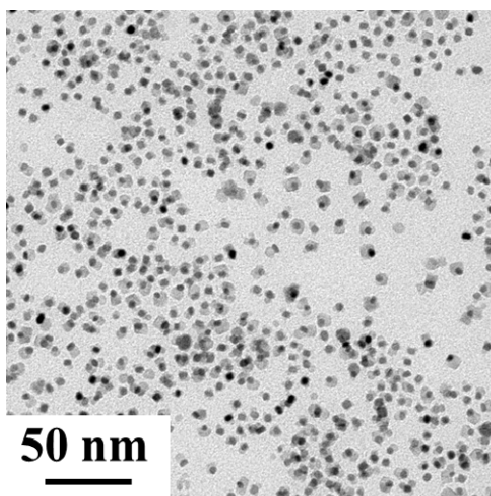
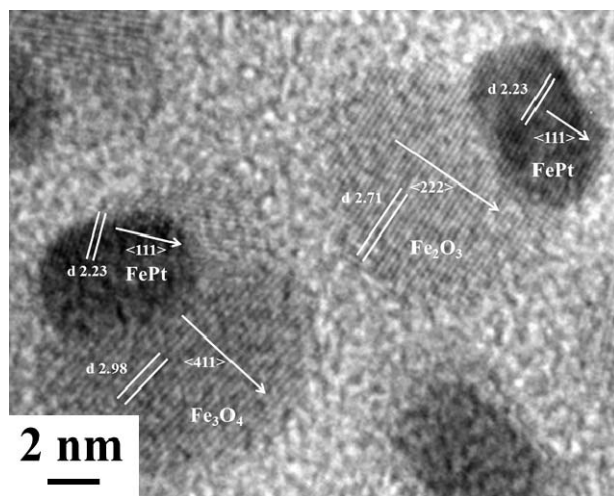


Figure S3. HR-TEM images, UV-vis spectra, and QCM data of 7 nm-sized OA-MnO

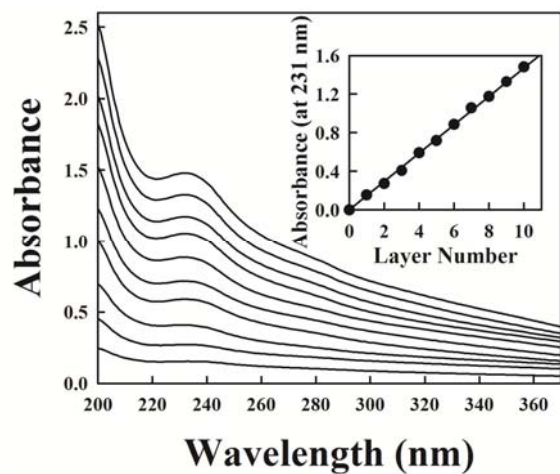
(a)



(b)



(c)



(d)

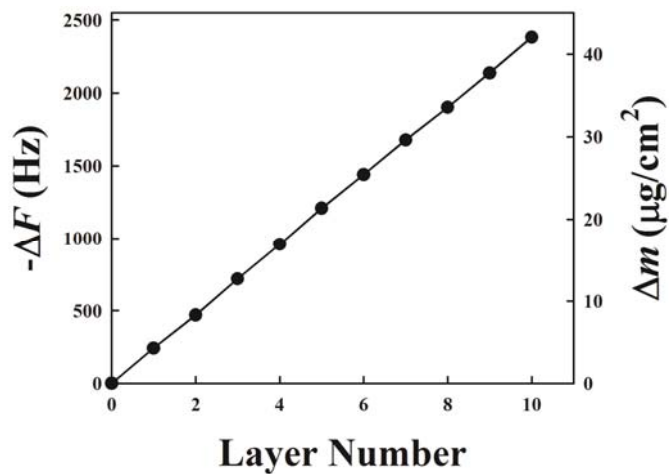


Figure S4. HR-TEM images, UV-vis spectra, and QCM data 6 nm-sized OA-FePt NPs

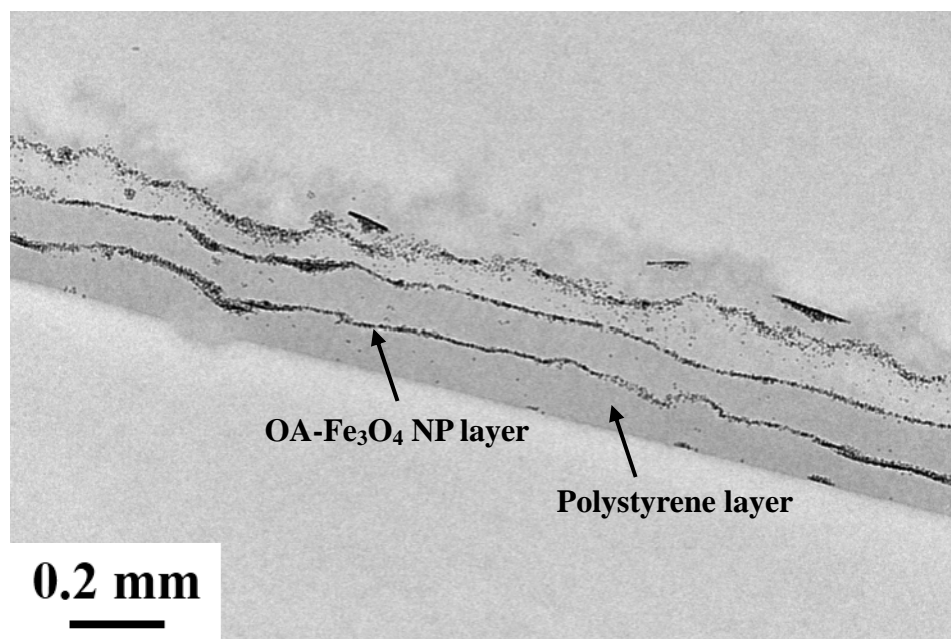


Figure S5. Cross-sectional HR-TEM image of spin-coated (polystyrene + PI + OA-Fe₃O₄ NPs)₃ film with photo-crosslinking reaction. In this case, 1 wt% polystyrene, 3 wt% PI and 0.5 wt% OA-Fe₃O₄ NP was used as a solution mixture.

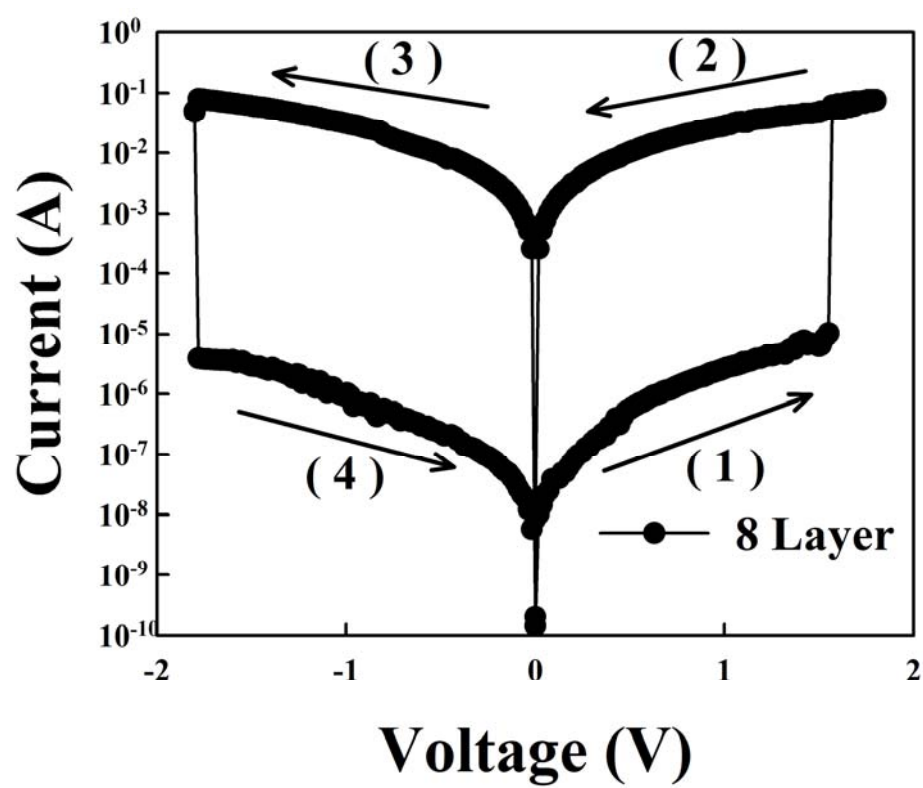


Figure S6. *I-V* curves of (photo-crosslinked OA-Fe₃O₄ NP)₈ multilayered device.

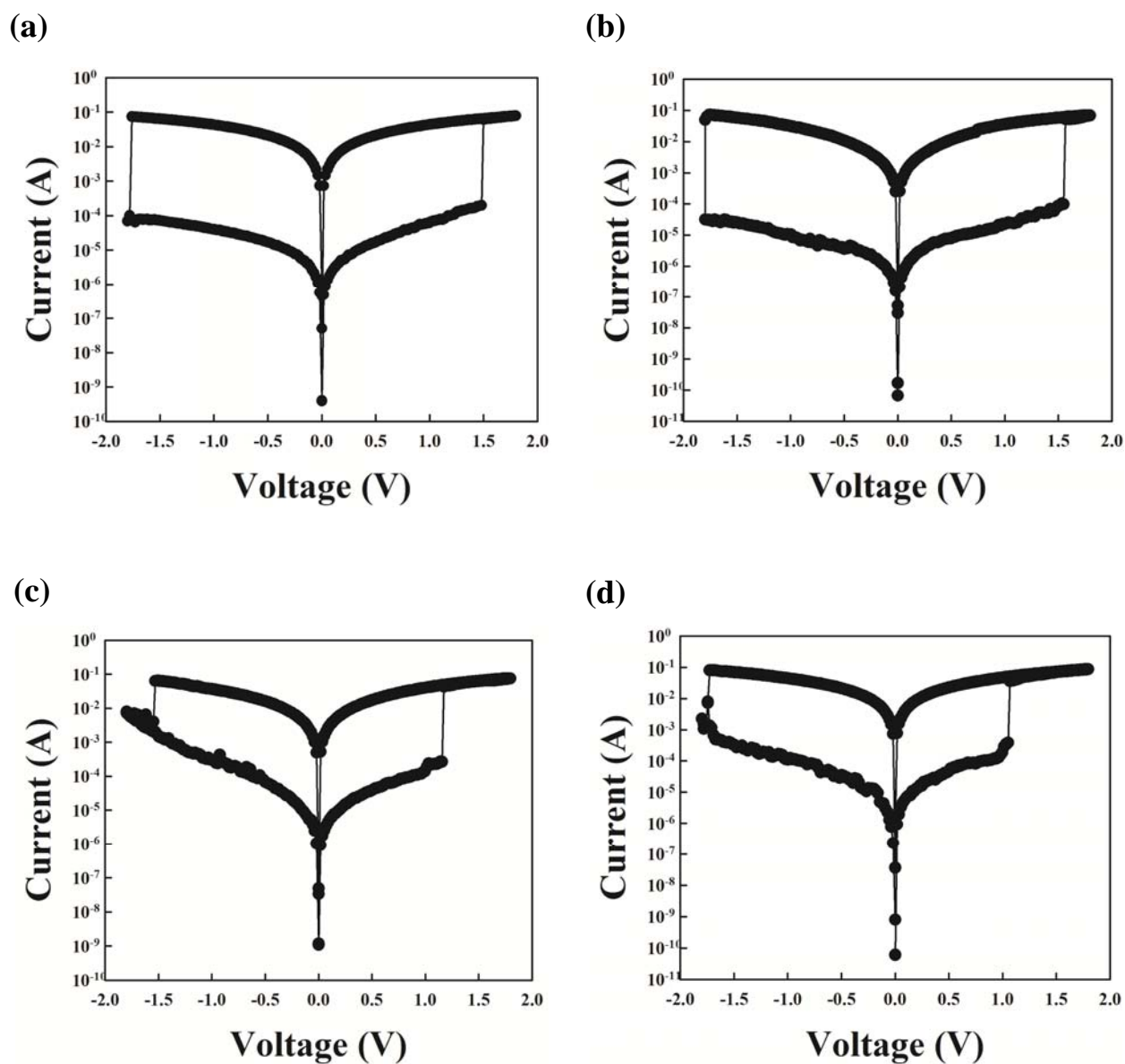


Figure S7. *I-V* curves of (photo-crosslinked OA-Fe₃O₄ NP)₆ multilayer devices measured from (a) W (tungsten) , (b) Ag (silver), (c) Au (gold), and (d) Pt (platinum) top electrodes.

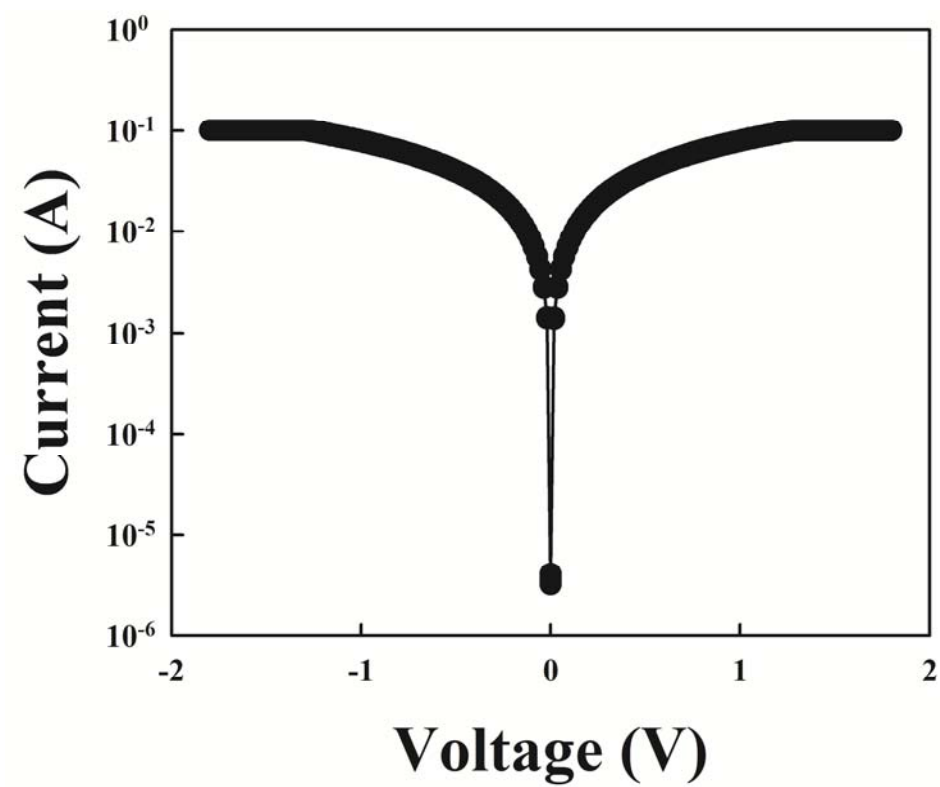


Figure S8. *I-V* curves of (photo-crosslinked OA-Fe₃O₄ NP)₆ multilayer devices with vacuum deposited Ag electrode.