

Supporting Information for Enhanced Photocurrent and Dynamic Response in Vertically Aligned $\text{In}_2\text{S}_3/\text{Ag}$ Core/Shell Nanorod Array Photoconductive Devices

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I. Additional SEM images of NPD without shell

As seen in Figure 1a, we measured Ag film thickness around 700 nm. Figure 1b and c show In_2S_3 nanorod arrays on ITO coated glass substrate and Si substrate, respectively. If we compare top view images of In_2S_3 nanorod arrays on different substrates, we can see that the morphology of nanorods do not change depending on substrates.

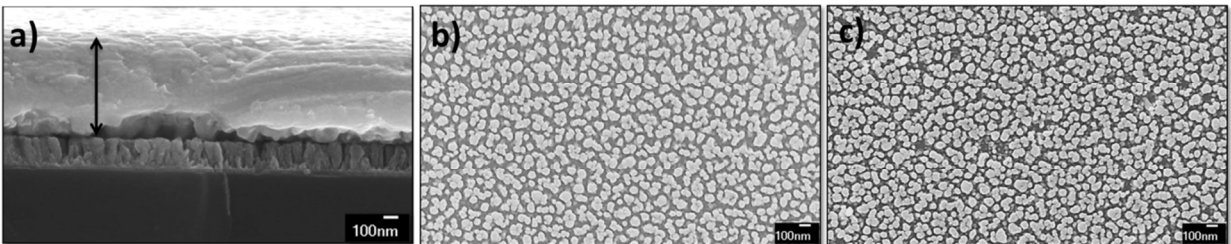


Figure 1: a) Cross-sectional SEM image of vertically aligned In_2S_3 nanorod arrays and bottom In_2S_3 film on Si substrate with a Ag metallic capping layer (two sided red arrow) on top of

nanorods, b) Top view SEM image of In_2S_3 nanorod arrays on ITO coated glass substrate, c) Top view SEM image of In_2S_3 nanorod arrays on Si substrate.

II. Ag shell thickness measurement with TEM Analysis

Figure 2 shows TEM images of In_2S_3 nanorods with thin and thick Ag layers. Blue lines are indicating the measured thickness of Ag layers. As seen in Table 1, thirteen data were collected for the thickness of thin Ag shell and six data were collected for thick Ag shell's thickness. Average of those data provided the measured thickness of the shells as 2.04 ± 0.61 nm and 3.89 ± 0.47 nm for thin and thick Ag shell, respectively.

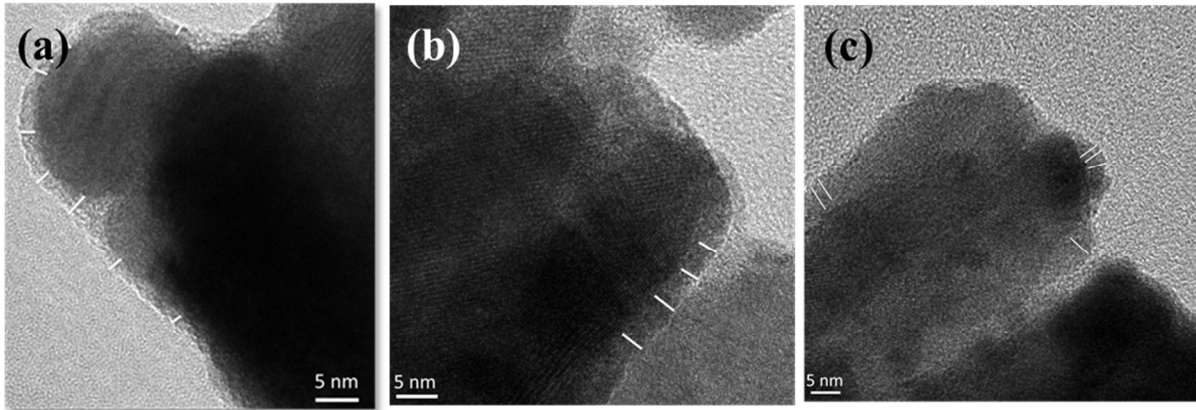


Figure 2: TEM images of (a) top portion and (b) bottom portion of an individual In_2S_3 nanorod with thin Ag layer (c) top portion of an individual In_2S_3 nanorod with thick Ag layer (blue lines indicate the measured thickness of Ag layer, scale bar 5 nm)

Table 1: Thickness data gained from TEM analysis for thin and thick Ag shell

Thin	1.19	1.35	1.39	1.7	1.77	1.77	1.84	1.91	2.44	2.44	2.75	2.96	2.96
Thick	4.5	4.1	3.58	3.58	3.32	4.28	-	-	-	-	-	-	-

III. I-V curves of NPDs under dark and illuminated condition

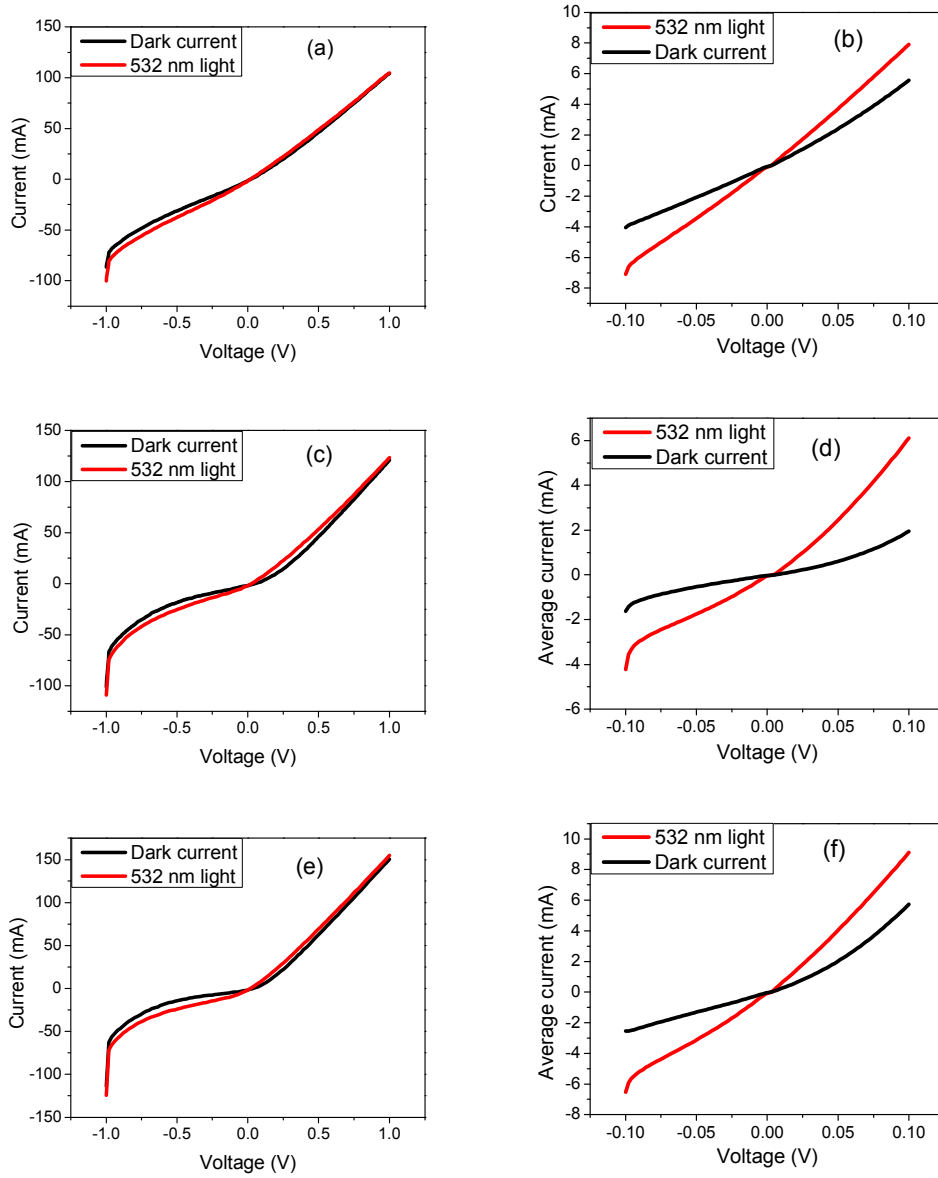


Figure 3: I-V curves for each nanostructured photoconductive device (NPD). I-V curve in (a) higher voltage range and (b) lower voltage range for NPD without shell, I-V curve in (c) higher voltage range and (d) lower voltage range for NPD with thin shell, I-V curve in (e) higher voltage range and (f) lower voltage range for NPD with thick shell.

IV. Optical Absorption Spectrum of NPD with and without metal shell

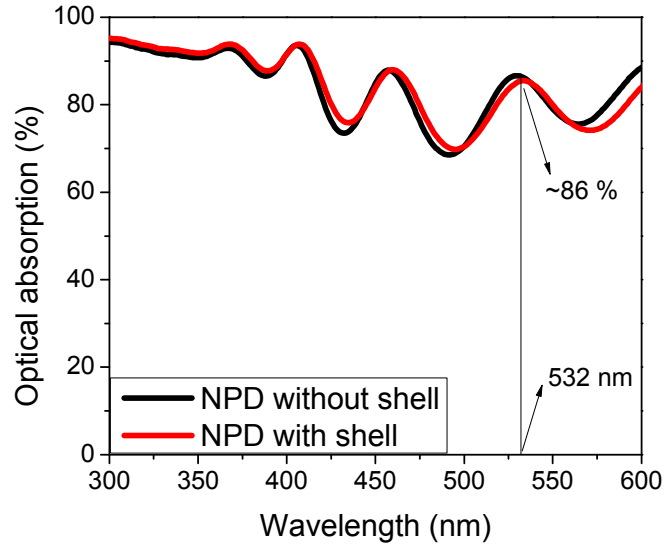


Figure 4: Optical absorption spectrum of NPD with and without metal shell

V. Estimation of carrier lifetimes by photocurrent decays

Carrier lifetimes were estimated with the weight-averaged time constants of the photocurrent decays for each NPD as in the following equation

$$\tau = \tau_1 \frac{A_1}{A_1 + A_2} + \tau_2 \frac{A_2}{A_1 + A_2} \quad (1)$$

where τ_1 and τ_2 are the decay constants and A_1 and A_2 the fitting constants derived from photocurrent decays after fitted to an exponential equation that has two decay constants like

$$I = A_1 e^{-\frac{t}{\tau_1}} + A_2 e^{-\frac{t}{\tau_2}} \quad (2)$$

τ_1 and τ_2 are the time constants for fast and slow decaying of photocurrent profiles.

Table 2: Fitting parameters of photocurrent decays (A_1 , A_2 , τ_1 , τ_2), weight-averaged time constants (τ) and mean value of time constants (τ_{average}) for each NPD.

		A_1	τ_1	A_2	τ_2	τ	τ_{average}
Core without shell	1 st decay	1.77285	0.27684	0.68404	2.89062	1.00456	1.07185
	2 nd decay	0.65344	3.72371	2.03773	0.41515	1.2185	
	3 rd decay	4.28779	0.48295	0.68863	4.16532	0.9925	
Core/Shell (thin)	1 st decay	4.32122	0.26789	0.4275	3.20658	0.53244	0.5783
	2 nd decay	4.97682	0.20032	0.56219	2.22356	0.40567	
	3 rd decay	4.2356	0.36178	0.34877	6.07943	0.79678	
Core/Shell (thick)	1 st decay	1.51174	2.82426	15.60384	0.33651	0.55624	0.68563
	2 nd decay	1.2758	3.33098	15.50689	0.4022	0.62484	
	3 rd decay	1.02962	4.26019	9.38595	0.50456	0.87582	

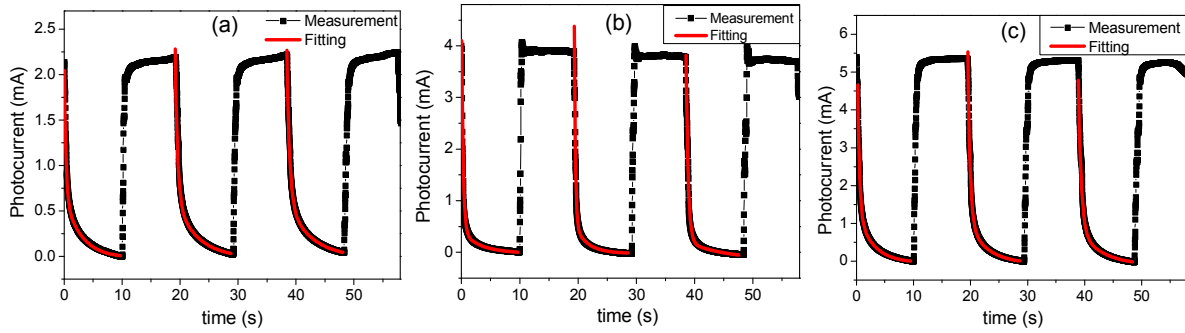


Figure 5: Photocurrent-time plots for (a) NPD without shell, (b) NPD with thin shell and (c) NPD with thick shell. Black lines (line and squares) indicate measurement and red solid lines show exponential fitting to the data.