Electronic Supporting Information

Integration of bacteriorhodopsin with upconversion nanoparticles for NIR- triggered photoelectrical response

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Experimental Section

H. salinarum was cultured at 40°C with continuous illumination (980 nm, 2000 mW) and proper shaking for 120 h. The bacteria were harvested at 13,000 g for 15 min and then re-suspending the cells in a basal salt medium, with 1 mg DNAse I added before the overnight dialysis against 0.1 M NaCl. The resulting solution was centrifuged at 40,000 g for 40 min to obtain the reddish purple sediment. After sucrose gradient centrifugation at 100,000 g for 17 h, the purple membranes containing bR were collected for the following experiments.

UV–vis absorption spectra of bR suspensions were measured with Shimadzu UV-2550 UV–vis spectrophotometer. bR suspension was dropped on a mice for atomic force microscopy test (Dimension Icon SPM, Bruker, USA). XRD spectra were captured with a Shimadzu (XRD-7000, Japan) 2500 diffractometer at a scanning rate of 5°/min in the 2θ range from 10 to 80°. SEM micrographs were obtained using a field emission scanning electron microscope (JSM-7800F, Tokyo, Janpan). Energy dispersive x-ray spectrometry (EDS) spectra were recorded by SEM JSM-6510LV instrument (JEOL, Tokyo, Janpan). The NIR-photoluminescence (PL) emission spectra were recorded with a Shimadzu RF-5301 PC spectrophotometer with a 980 nm fiber coupling laser (FC-980-2000-MM, Shanghai Xi Long Optoelectronics Technology Co., Ltd., China) as the excitation source.

bR and PEI-UNPs suspensions were dropped on a ITO slide (1cm^2) and a IRCF (Cutoff wavelength range 700-1100nm,1 cm^2), respectively, followed by drying at 30 °C for 1 hr. The ITO and the IRCF were mounted together back to back, facilitating the photo energy transfer from the excited UNPs to bR. A U-shaped groove was attached between the ITO/IRCF stacking electrode (working electrode) and a platinum sheet electrode (counter electrode), forming a closed container for the loading of electrolyte solution. CHI 660E potentiostat (Shanghai Chenhua Instrumental Cooperation Ltd., China) was used to quantify the photoelectric response with amperometric measurements at open circuit potential.

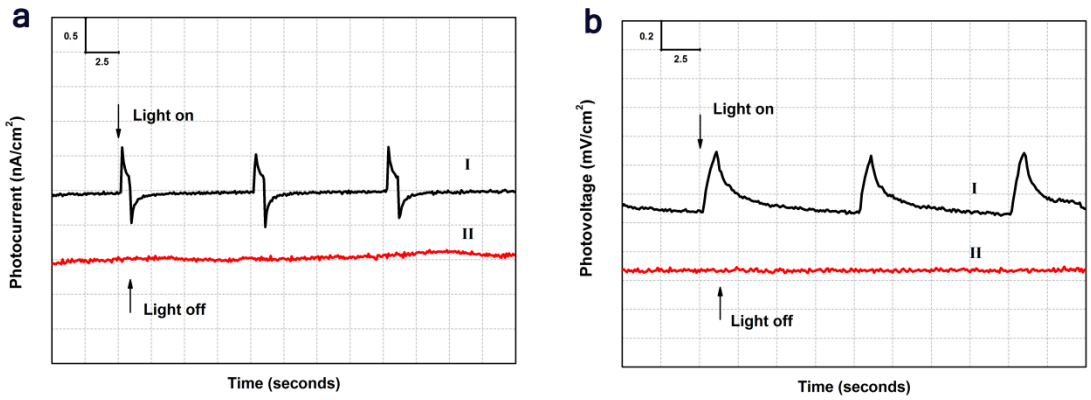

Fig. S1 (a) Photocurrent profile of (I) device generated by IR, (II) device after IR was filted; (b) Photovoltage of (I) device generated by IR, (II) device after IR was filted;