Supporting Information

Tin oxide/Silicon Heterojunction with Nano Litchi Shell Structure for Ultrafast, High-Detectivity, Self-Powered Broadband Photodetectors

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Characterization: Emission scanning electron microscope (SEM, JEOL JSM6500) and transmission electron microscope (TEM, FEI Tecnai G2 F20/F30) were used to observe the morphology and microstructure of SnO_2 nano litchi shell structure, the crystal structure and phase composition of the samples were obtained by X-ray diffraction (XRD, X'Pert PRO MPD), the composition and valence of the sample were analyzed by X-ray photoelectron spectroscopy (XPS, ESCALAB 250Xi) and Raman spectroscopy (Raman, HORIBA JOBIN YVON, LabRAMHR800), UV-VIS-NIR spectrometer (HITACHI, U-4100) was used to observe the absorption intensity of the samples to various bands of light, the energy band information of samples is obtained through ultraviolet photoelectron spectrometer (UPS, ESCALAB 250Xi). Photoluminescence (PL) spectrum was recorded on a FLS920 fluorescence lifetime spectrophotometer (Edinburgh Instruments, UK).

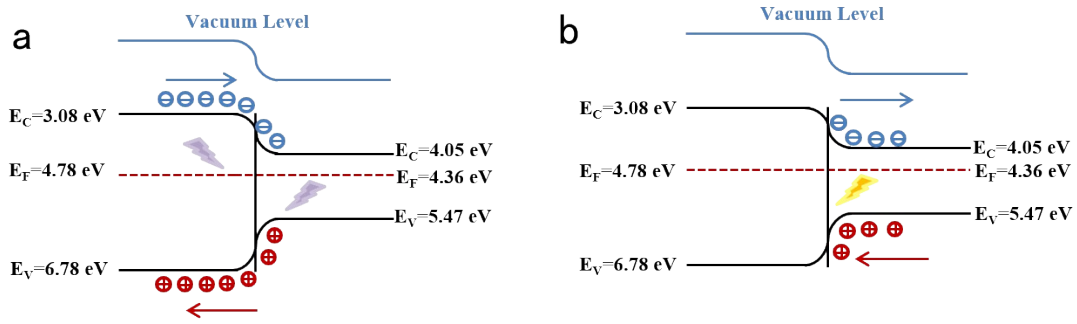

Fig. S1. Schematic energy band diagram of the SnO_2 nano litchi shell structure/*n*-Si heterojunction with different incident light. (a) with UV light. (b) with VIS light.

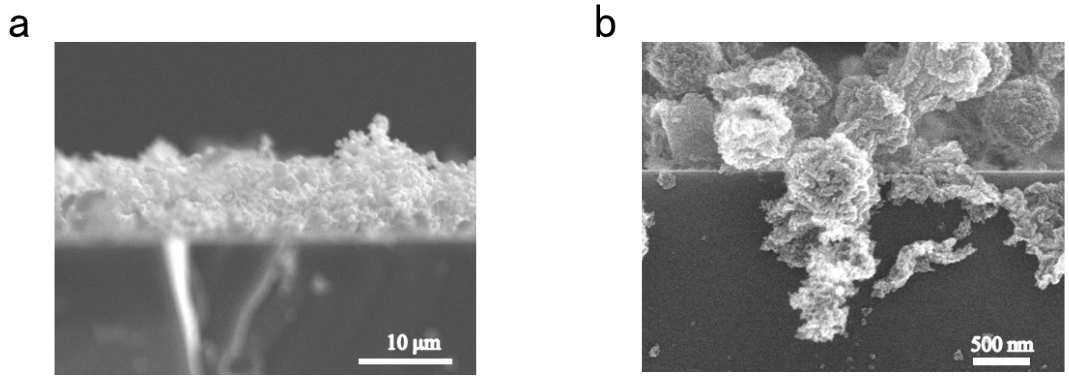

Fig. S2. The section of the SnO_2 nano litchi shell structure/*n*-Si heterojunction. (a) overall, (b) partial.

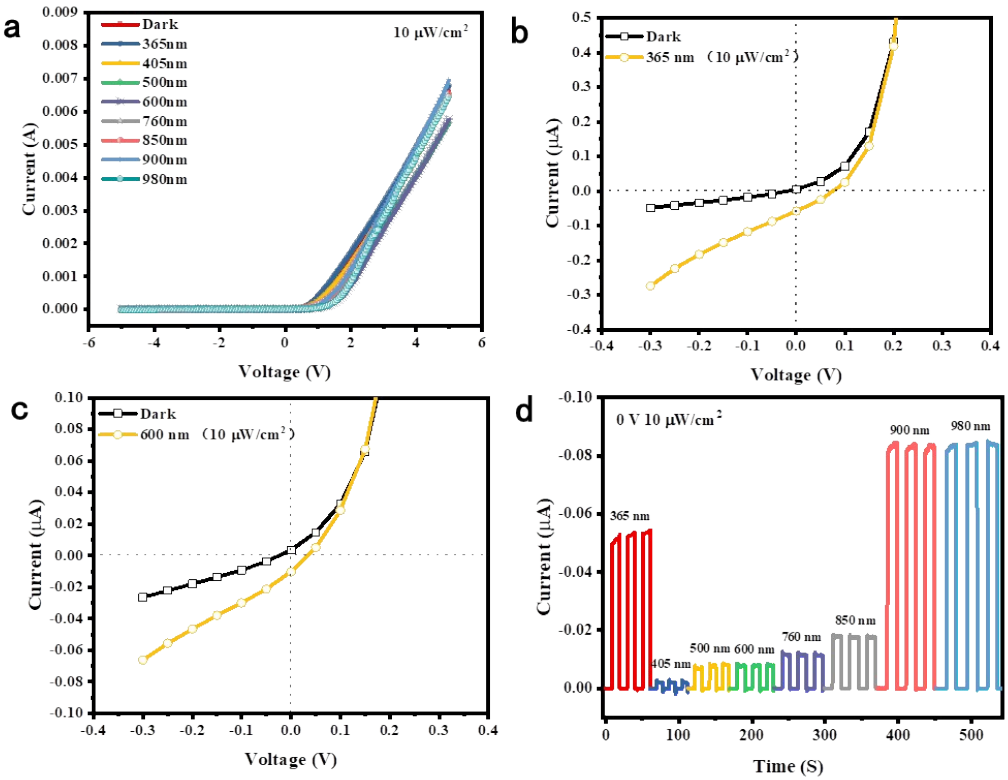

Fig. S3. Photoresponse characteristics of the SnO_2 nano litchi shell structure/*n*-Si heterojunction photodetector. (a) The *I-V* characteristics of the photodetector at dark and different monochromatic lights (10 μW/cm^2). The *I-V* characteristics of the photodetector measured at the dark and (b) 365 nm, (c) 600 nm illumination (10 μw/cm^2). (d) The photoswitching curves of the photodetector under illumination (10 μW/cm^2, 0 V) with different wavelength lights.

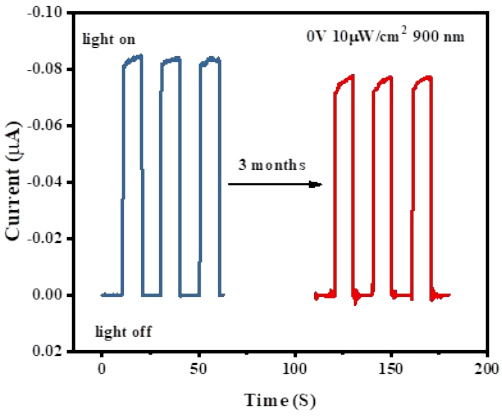

Fig. S4. The comparison of photoswitching curves of the photodetector after storing it in natural conditions for 3 months.

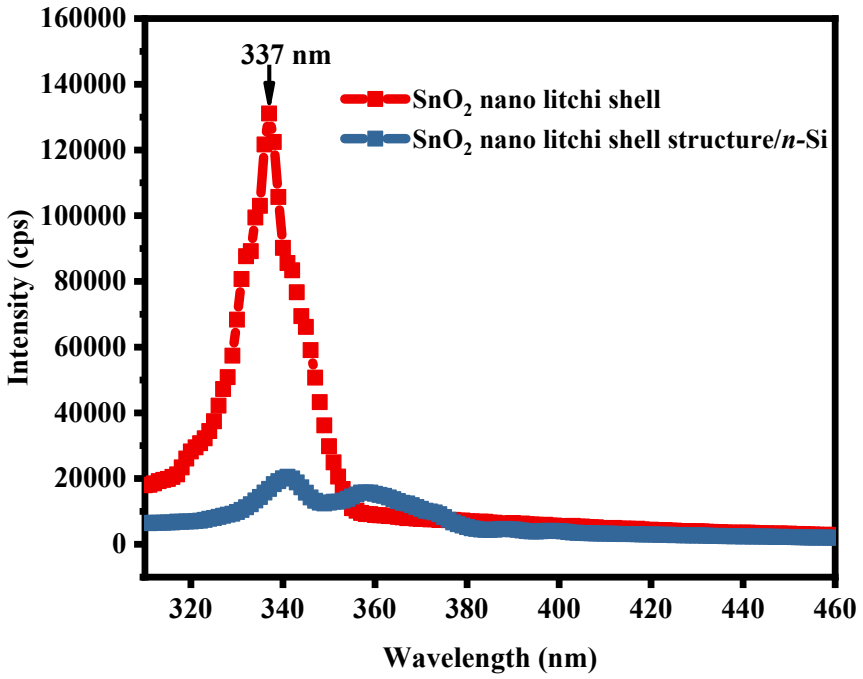

Fig. S5. PL graph of the SnO_2 nano litchi shell and the SnO_2 nano litchi shell structure/*n*-Si.

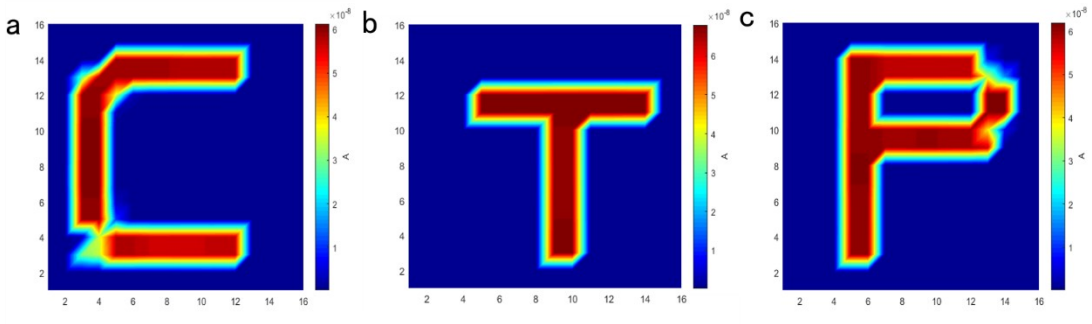

Fig. S6. Transmission imaging. **(**a-c) Images with shapes of “C”, “T”, and “P” under 900 nm illumination, the pixels are 16×16.