Electronic Supplementary Information

Three-Dimensional Nano-Heterojunction Networks: A Highly Performing Structure for Fast Visible-Blind UV Photodetectors

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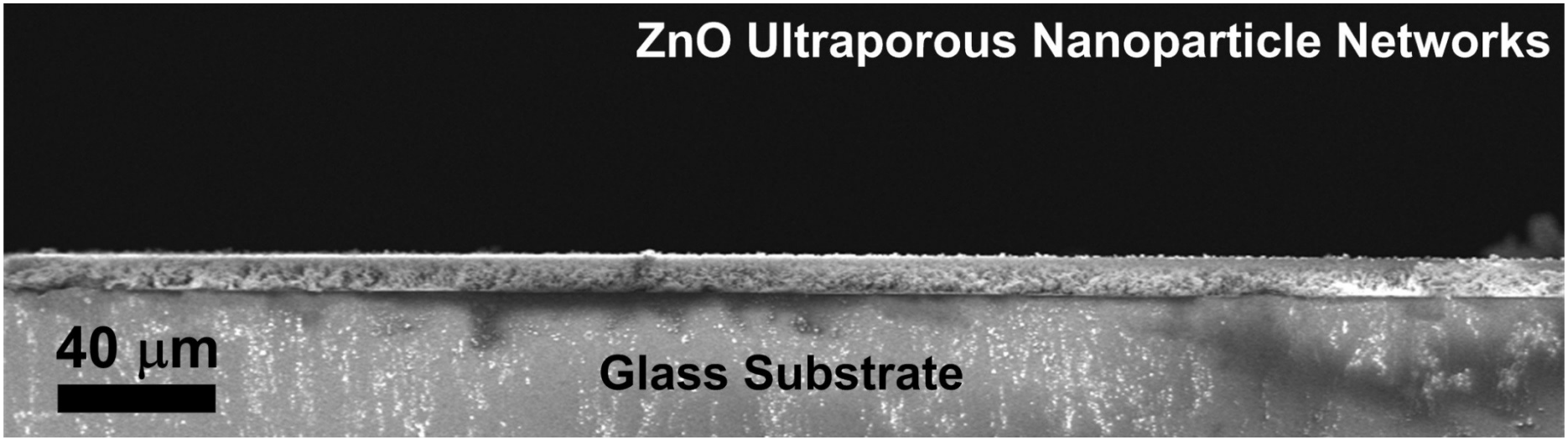

Figure S1. Cross-section SEM images of an exemplary ZnO ultraporous nanoparticle networks deposited on glass substrate with 100 s deposition time.

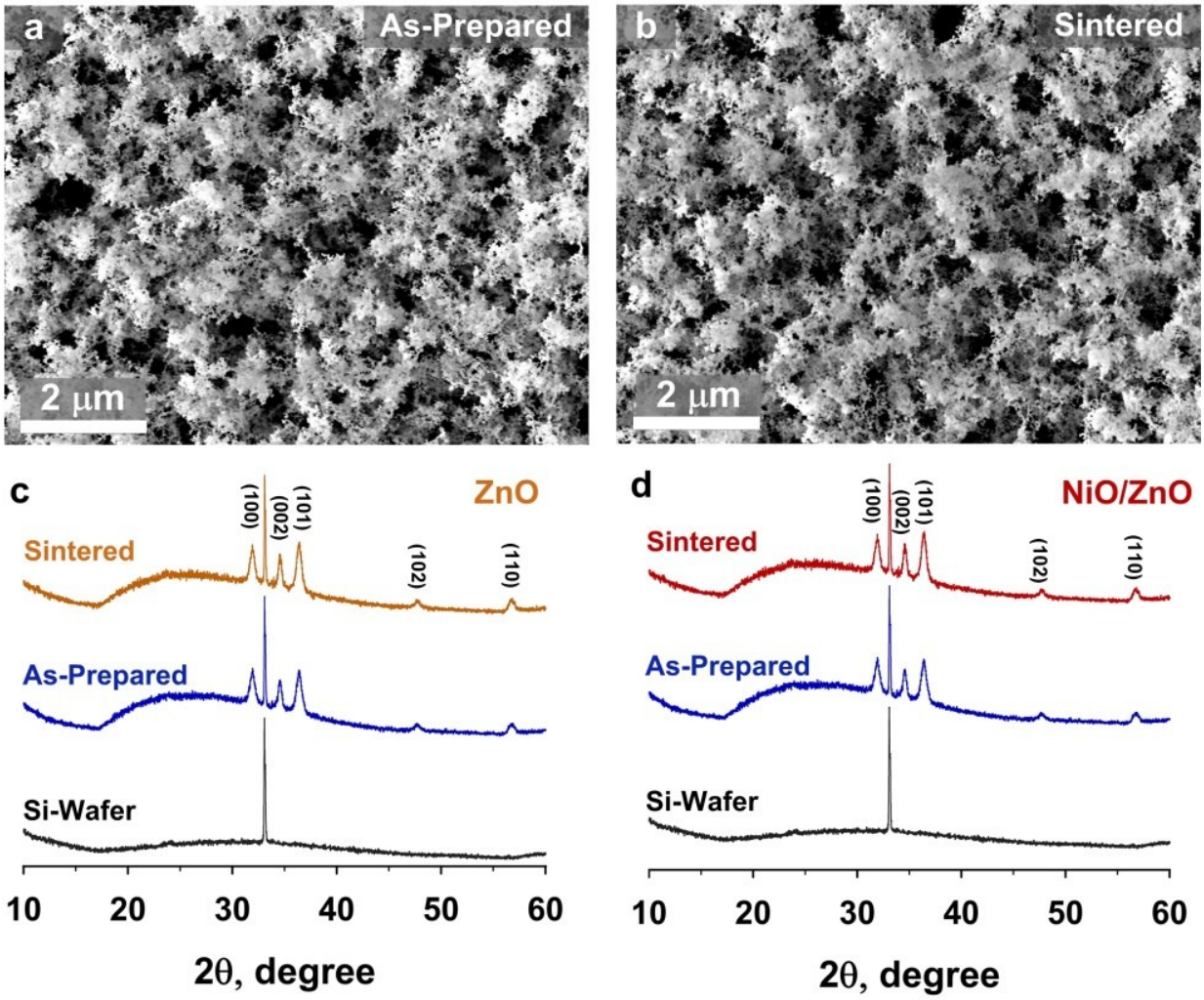

Figure S2. (a,b) SEM images and (c,d) XRD patterns of the pure ZnO and 3DNH NiO/ZnO device with 40 s NiO sputtering time (a,c) before and (b,d) after sintering at 300 ºC for 12 h.

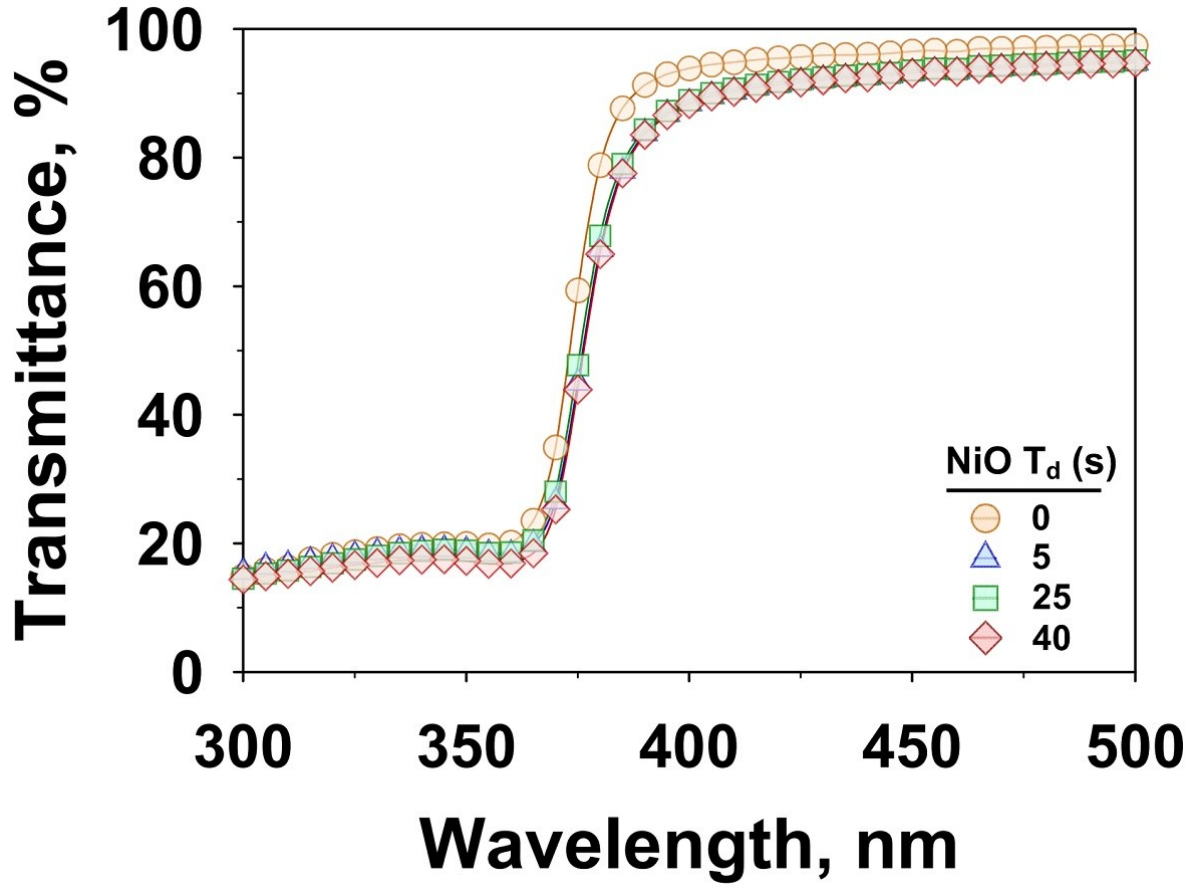

Figure S3. Optical transmittance of the devices after subtraction of the fraction loss through the glass substrate.

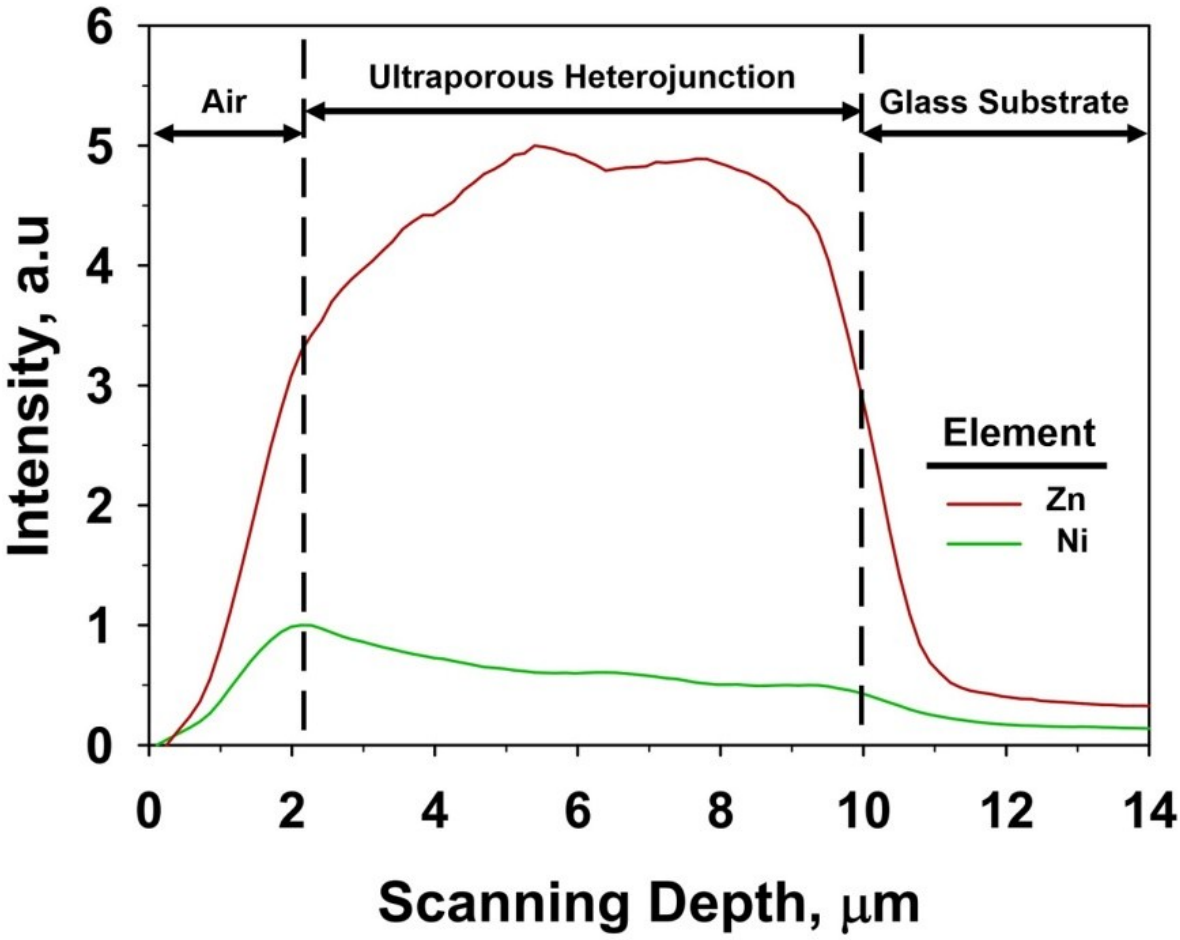

Figure S4. EDXs intensity line profiles showing the Zn and Ni element distributions along the film cross-section.

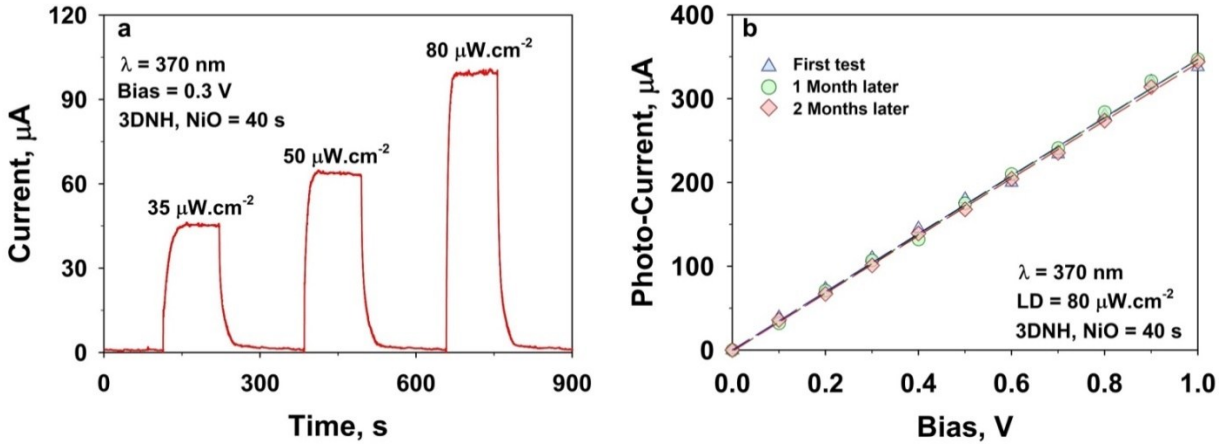

Figure S5. (a) Time-dependent photodetector response of the UNN annealed at 300 °C to alternative exposure of light with a light density of 35, 50 and 80 μW.cm^{-2} at a bias of 0.3 V and a wavelength of 370 nm. (b) *I-V* characteristic of 3DNH device with 40 s NiO sputtering time at λ = 370 nm and the light density of 80 μW.cm^{-2} after 1 and 2 months storage.

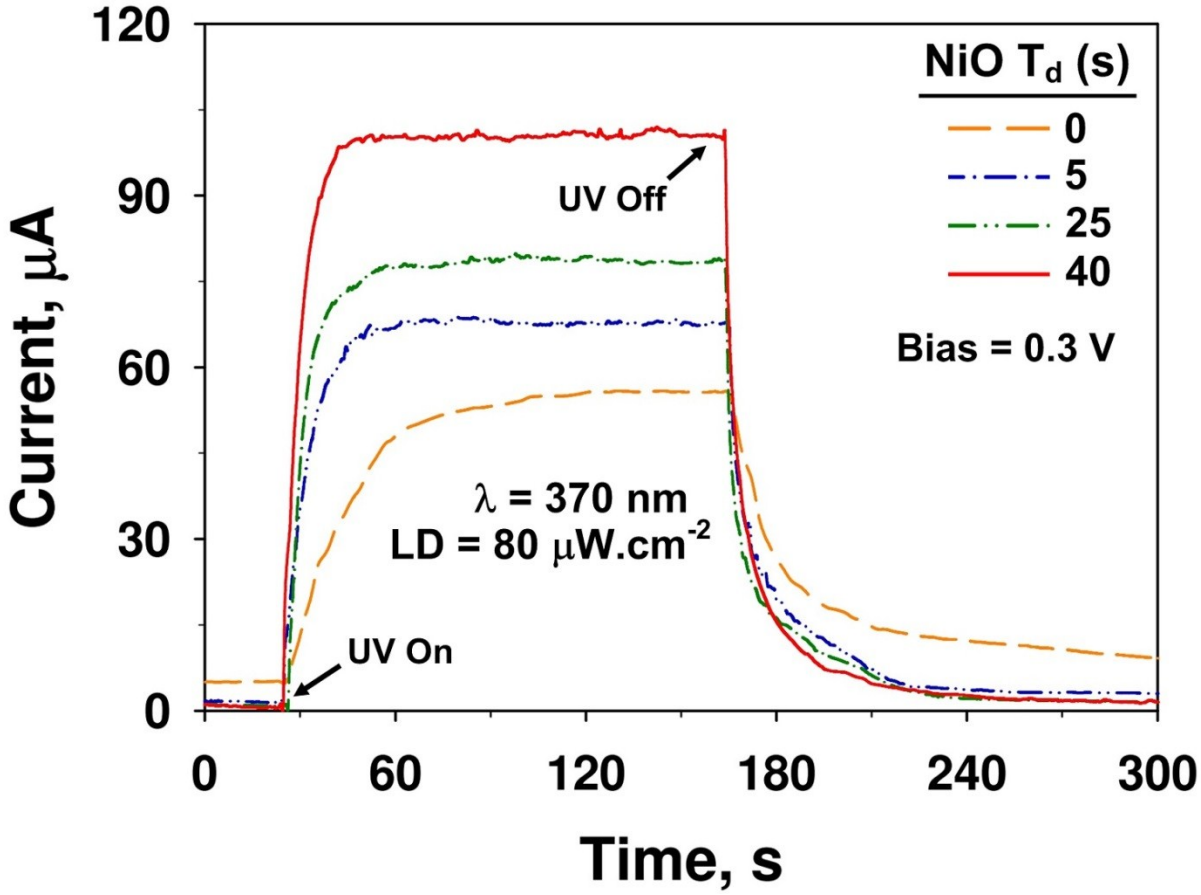

Figure S6. Photo-current dynamics of the pure ZnO and NiO/ZnO 3DNH devices with different NiO deposition time (5 to 40 s) at an applied bias of 0.3 V, light density of 80 μW.cm^{-2} and a wavelength of 370 nm.

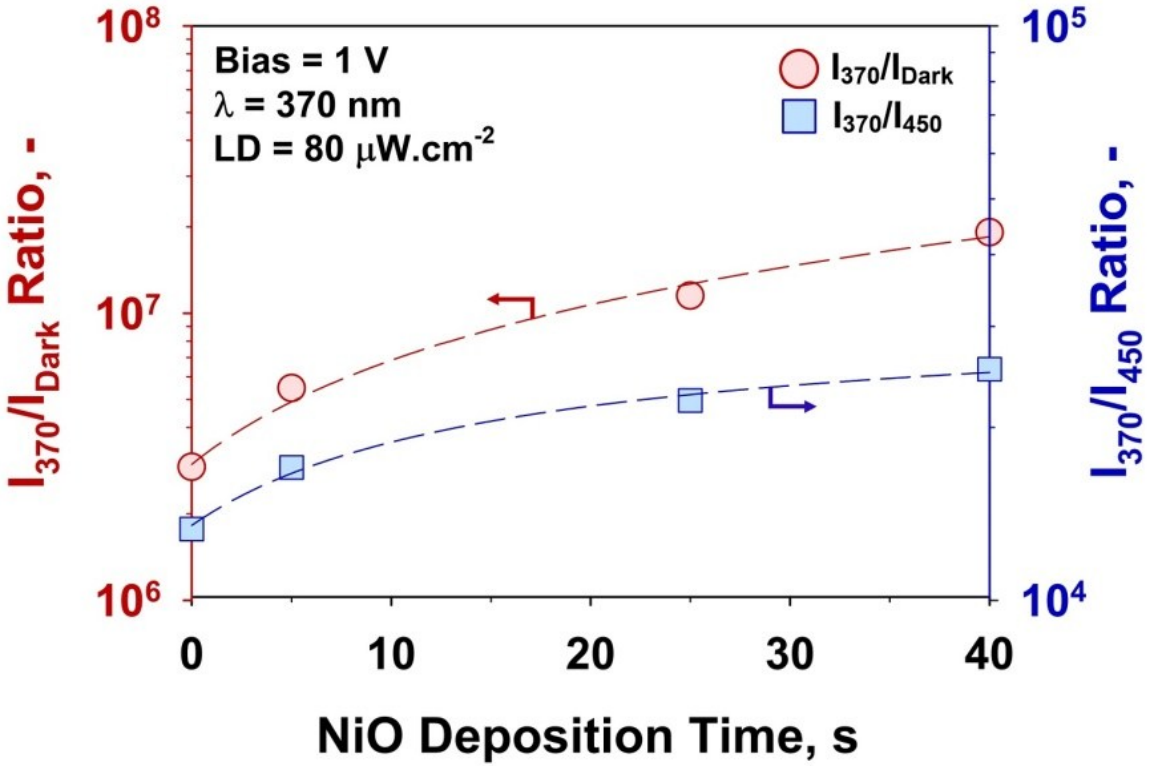

Figure S7. I_{370}/I_{Dark} and I_{370}/I_{450} ratios of photodetector devices with different NiO deposition time at the wavelength of 370 nm and the applied bias of 1 V.

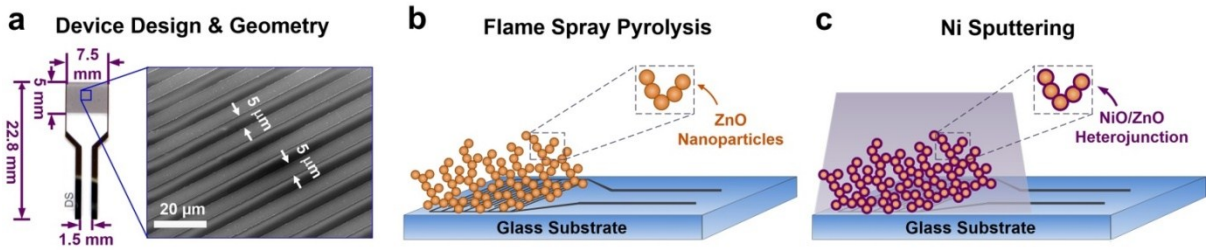

Figure S8. (a) The photo and schematic of the interdigitated Pt electrode substrates. (b) An ultraporous ZnO nanoparticle networks self-assembled on glass substrate and (c) physical sputtering deposition of the NiO clusters on the ZnO nanoparticle networks.