Supporting Information

Dual Wavelength (Ultraviolet and Green) Photodetectors Using Solution Processed Zinc Oxide Nanoparticles

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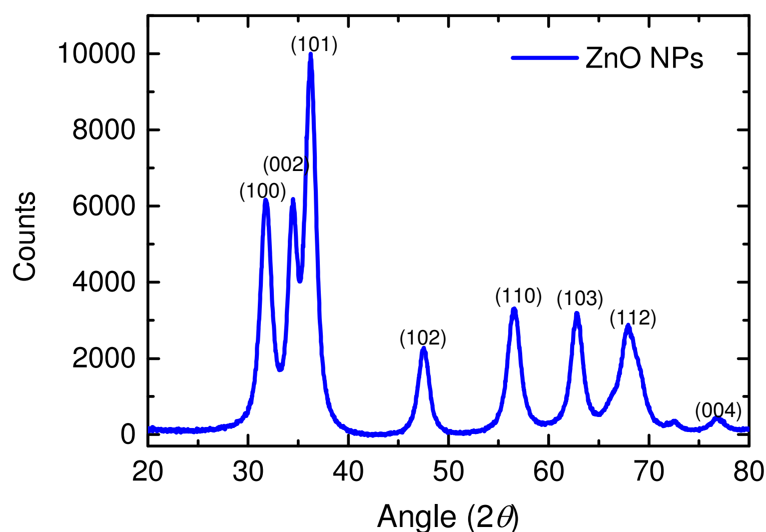

Figure S1. X-ray diffraction of the ZnO NPs prepared by sol gel method. The spectra was taken to ZnO in the powder form. The particles show the typical diffraction pattern of the wurtzite crystal structure.

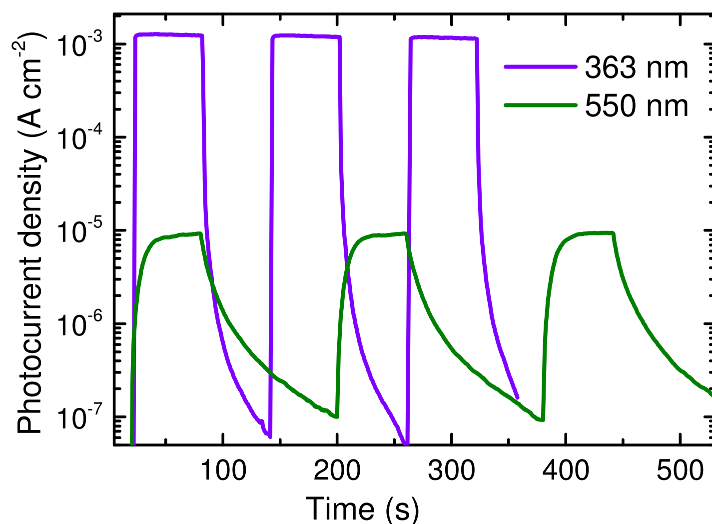

Figure S2. A semi-log plot of the current transients of ZnO NPs in response to the light in the UV (363 nm) and green (550 nm) for the same working device. The device was annealed at 350 ^{o}C for 2 hours in air. The incident light pulse length was 60 seconds for both, and the

time interval between each light pulse was 60 seconds for the UV and 120 seconds for the green. The responsivity in the UV and green is 8.6 A W^{-1} and 0.18 A W^{-1} respectively.

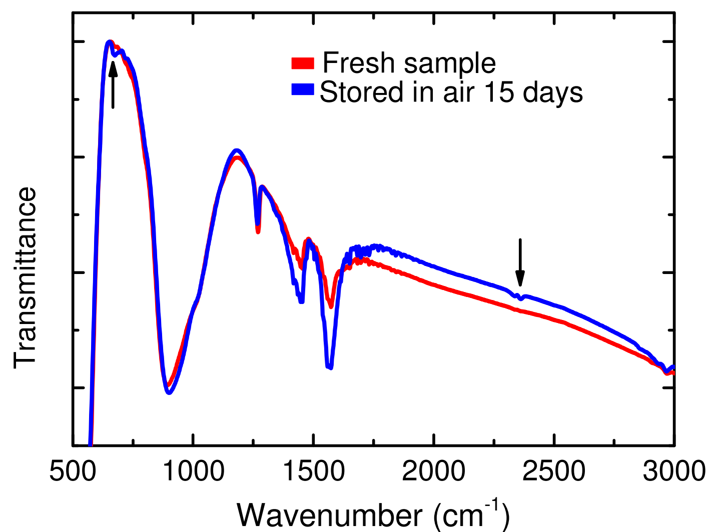

Figure S3. FTIR spectra from Figure 3b showing transitions due to free CO_2 at 673 cm^{-1}, 2332 $cm^{-1}$and 2362 cm^{-1}, indicated by arrows, increase in intensity following 15 days storage in air. The sample was annealed at 350 °C in air for 1 hour, measured immediately and after storage in air for 15 days.

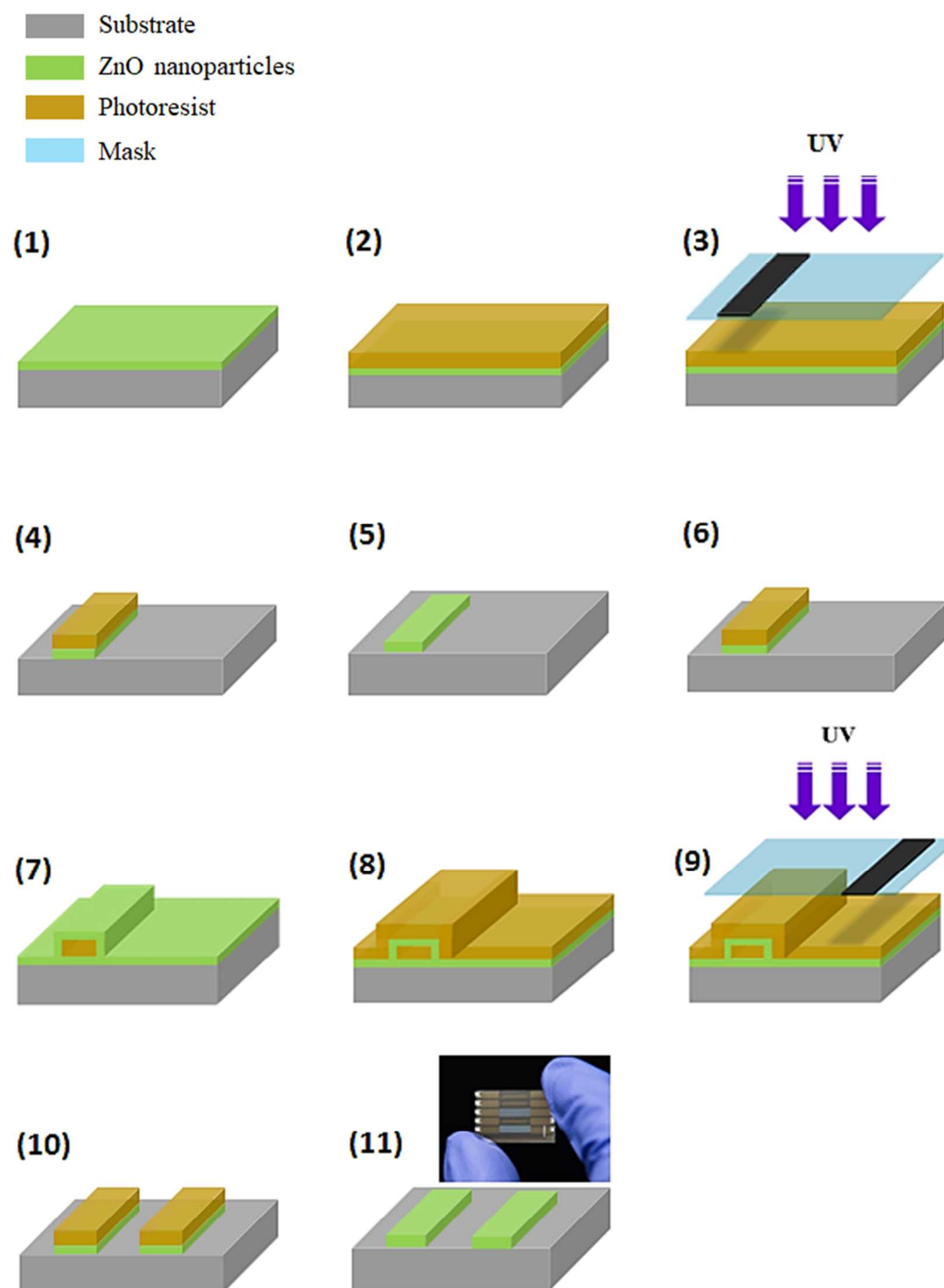

Figure S4. Photolithography procedure followed to fabricate pixelated photodetector. The fabrication process of two ZnO NPs pixels is summarized and depicted in steps numbered from 1 to 11 and described in details in text below.

1. The substrate was cleaned thoroughly by sonication for 10m in deionised (DI) water, acetone and propanol. Then, ZnO NPs (2.5%, dissolved in chloroform) were spin coated on top of the substrate at 2000 rpm, for 30 sec. The solution was filtered with 0.45 µm PTFE filter to remove the aggregated particles. After spin coating, the substrate was soft baked at 100 °C, for 5m in air.
2. The photoresist (AZ5214) was spin coated on top of the ZnO NPs at 3000 rpm for 30 sec. Then, the substrate was baked at 100 °C for 1m.
3. The first pixel was defined by covering the wanted area by a mask (printable transparent paper) and then the film was irradiated to the UV for about 90 s.
4. The substrate was washed with the developer by dipping it in and out for about 40 s, followed by washing with deionised water. In this step, the irradiated photoresist and the ZnO NPs beneath it were removed by the developer leaving the area covered by the mask protected.
5. The pixelated ZnO NPs are washed with acetone to remove the protecting photoresist layer on top. Then, the substrate was immersed in acetone for about 1m and dried with N_2 and then baked at 100 °C for 5m. The device was annealed at 350 °C in air for 1 hour, to improve the photoconductivity of the ZnO NPs in the green.
6. The first pixel was covered with the photoresist for protection. This was done by spin coating the photoresist at 2000 rpm for 30 s. The protective photoresist layer was relatively thick so that the UV light would not significantly penetrate to P1. After that, the substrate was baked at 100 °C for 2m. Then, the same mask was used as for step 3 to cover P1 and irradiate the rest of the area with UV for 90 s. After that, the substrate was washed with the developer and DI water, so that photoresist only overlays P1.
7. The substrate was spin coated with ZnO NPs at 2000 rpm for 30 s, followed by baking at 100 °C for 5m.
8. The photoresist layer was spin coated at 3000 rpm for 30 s on top of the ZnO NPs, followed by baking at 100 °C for 1m.
9. The second pixel, P2, was defined using a second mask to cover the required area and irradiating the rest of the substrate (including P1) with UV for 1m.
10. The substrate was washed with the developer and the DI water leaving both P1 and P2 covered with the photoresist.

11. The substrate was washed with acetone and DI water to remove the protecting photoresist on P1 and P2. Then, the substrate was soft baked at 100 °C for 10m to remove the remaining solution.