Electronic Supplemental Information

Ultrafast UV Response Detectors based on Multi-channel ZnO Nanowire Networks

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Single ZnO Nanowire UV Performance Testing

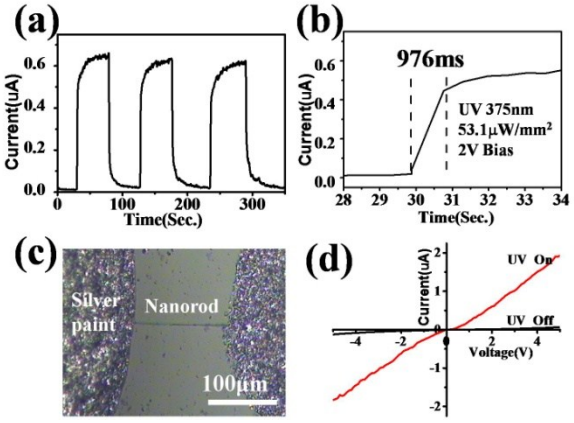

Fig. S1. UV light response results of UV sensor based on single ZnO nanowire. (a) is the on-off ratio; (b) Response time (976 ms); (c) Single ZnO nanowire UV detector; (d) I–V characteristics of the device exposed to 375 nm light with different power densities.

Materials and Methods

The silicon (Silicon/SiO_2/Silicon) thin film substrate was firstly fabricated by ion sputtered method.. The substrate is heated for 1min at 120 degree after coated by S1818 photoresist with a 2500 rpm of a spin coater. And then, period square pillars microstructure with size of 20um×20um top area and around 1um height was fabricated on substrates surface by RIE (Magnetic Enhanced Reactive Ion Etching, SF_6: CHF_3=10: 40) after UV lithography process as shown as Fig.S2.

The synthesis process of ZnO nanowire is that equal weight of ZnO and graphite powder were mixed together and placed in a ceramic boat, which was placed at the center of a ceramic tube in the vacuum tube furnace (BTF-1200C, BEQ) as shown as Fig. S3. The substrate with square period pillars microstructure was cleaned and put top down right above the source materials. Then, the whole system was pumped down to 0.2 mbar by an oil pump. 100 sccm nitrogen and 1.5 sccm oxygen were introduced into the chamber to bring the system pressure back to 300 mbar. By keeping a constant pressure of 300 mbar, the system then was heated up to 960 °C at a rate of 20°C/min.After keeping at peak temperature for 30 mins duration, the furnace was shut down and naturally cooled to room temperature.

The structural characterizations of the as-synthesized ZnO were carried out using X-ray diffract meter (XRD, X'Pert3 Powder) with Cu Kr radiation, a Field-Emission Scanning Electron Microscope (FESEM, JEOL-7800F), and a Transmission Electron Microscope (TEM, FEI Tecnai G2 F20). I-V curve and photoresponse performance were measured by probe station (PW-400)

system with sourcemeter (Keithley 2450) and a 375nm laser with an optical fiber output.

The UV sensor device was fabricated by UV lithography process as shown as in Fig.S4, a thin film of PDMS covered the nanowires network sample by stirring and heating curing process. Then, the lateral nanowires surface expose to air after suitable RIE etching. The top two Au film electrodes was sputtered after UV lithography process and acetone lift off process.

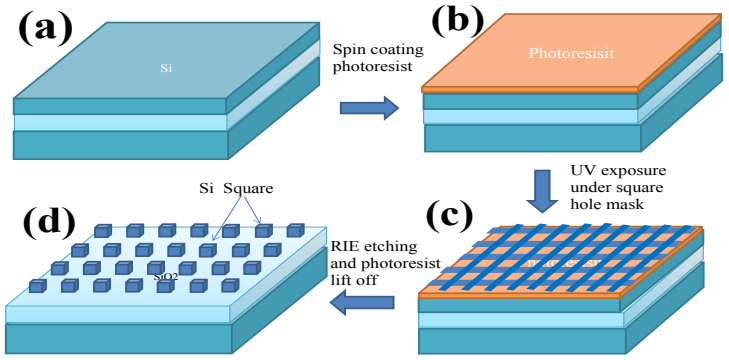

Fig. S2. The fabrication process of SiO_2 nanorod with RIE method.

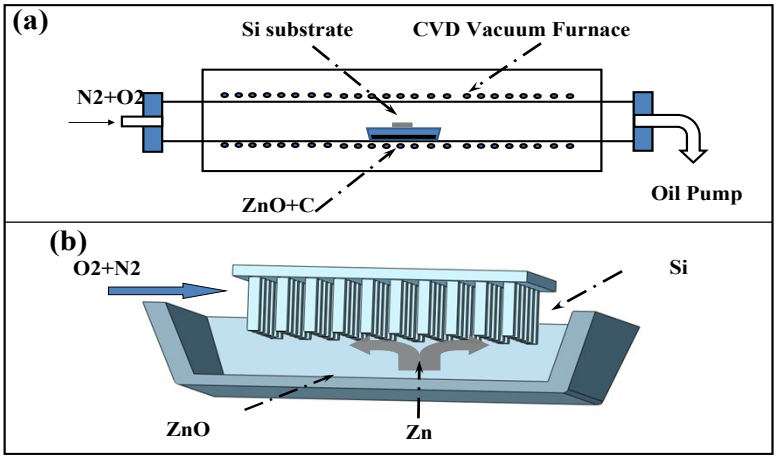

Fig. S3. The process of ZnO nanowire growth by CVD.

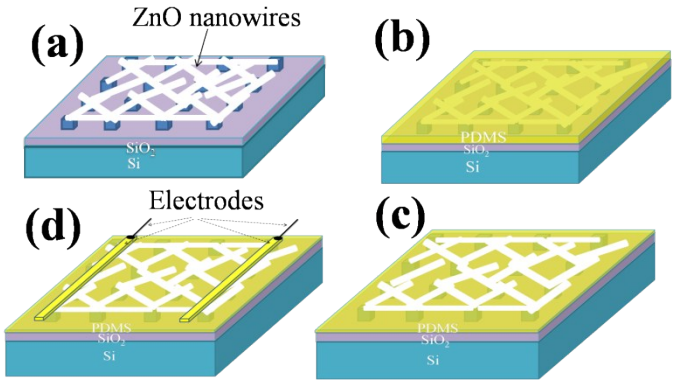

Fig. S4. The fabrication process of UV sensor with PMMA and Au electrode.