Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

The enhancement of self-powered UV photodetector based on vertical aligned Ag-modified ZnO nanowires

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Characterization

The morphology of Ag-ZnO NWs and ZnO NWs was characterized by field-emission scanning electron microscopy (FE-SEM Hitachi S-4800). The electrical properties of the samples were studied by current-voltage (I-V) measurements, which were carried out using Agilent E5270B parameter analyser under ambient conditions. The temporal response of the UV detector was measured by illuminating the devices with a UVA-LED (60 μWcm^{-2}). The UV-visible absorption and diffuse reflectance spectra were recorded with a spectrophotometer (UV-3600).

Supporting Information I:

SEM images of Ag-modified ZnO NWs prepared at different $AgNO_3$ concentrations

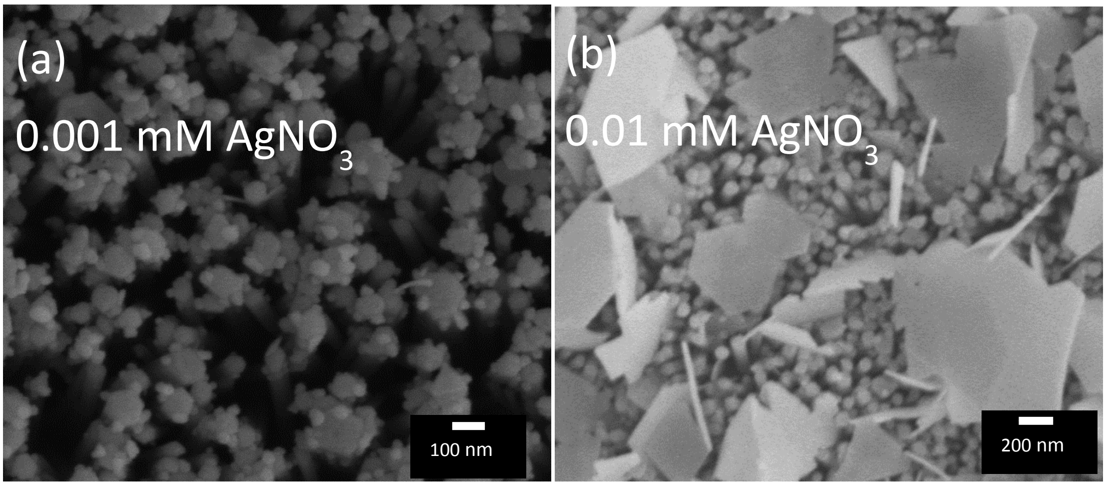

Fig. R1 SEM images of Ag-modified ZnO nanowires prepared at different $AgNO_3$ concentrations

Supporting Information II:

UV-visible light absorption and diffuse reflectance spectra of ZnO NWs and Ag-ZnO NWs prepared at different $AgNO_3$ concentrations

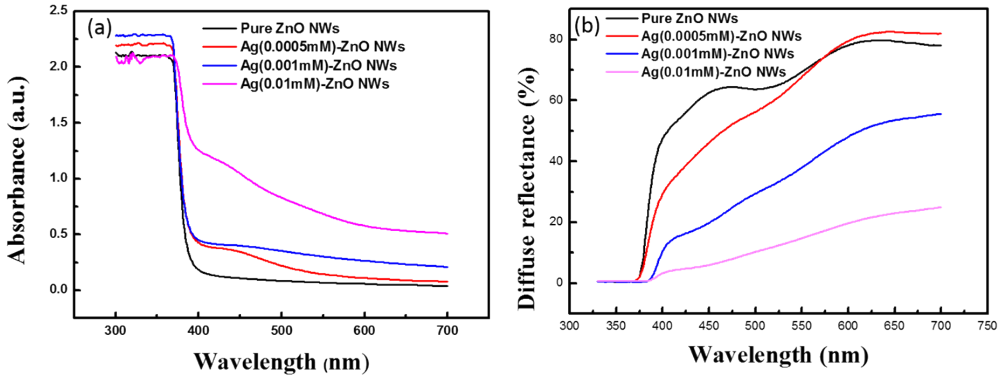

Fig. R2 (a) UV-visible light absorption spectra of ZnO NWs and Ag-ZnO NWs prepared at different $AgNO_3$ concentrations; (b) UV-visible diffuse reflectance spectra of ZnO NWs and Ag-ZnO NWs prepared at different $AgNO_3$ concentrations

Supporting Information III:

I-V and photoresponse characteristics of typical Ag(0.01mM)-ZnO NWs/water UV detector

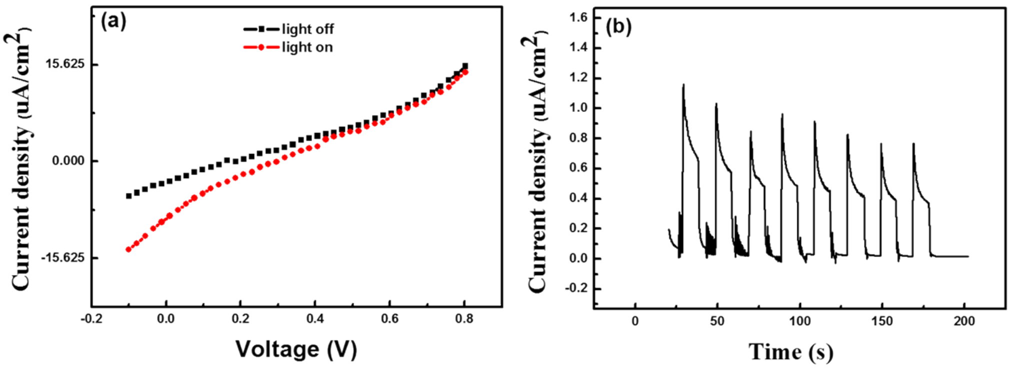

Fig. R3 (a) I-V characteristics of typical Ag(0.01mM)-ZnO NWs/water UV detector in darkness and under the illumination of 60 μW/cm^2 of UV light (λ=365nm); (b) Photocurrent density response of Ag(0.01mM)-ZnO NWs based device under on/off radiation of 60 μW/cm^2 of UV light (λ=365nn)

Analysis:

We prepare samples with different Ag size and plot the UV-visible absorption spectra and UV-visible light diffuse reflection spectra. Herein, SEM images of ZnO NWs decorated with different Ag nanoparticles size are shown in Fig. R1 (a) and (b). The higher the concentration of $AgNO_3$ is, the bigger the size of Ag nanoparticle is. As shown in Fig. R2 (a), when the concentration of $AgNO_3$ is 0.001 mM, the Ag modified ZnO NWs show the highest absorption value in UV-A region. When the concentration of $AgNO_3$ is 0.01 mM, the sheets of Ag are formed, and the absorption value in UV-A range is slightly decreased, which is close to that of bare ZnO NWs based device. The I-V characteristics curve of UV detector based on Ag (0.01 mM)-ZnO NWs under dark and 365 nm UV illumination of 60 $\mu W/cm^2$ is shown in Fig. R3 (a) and the photocurrent response curve of the device is shown in Fig. R3 (b). It is found that the value of photocurrent is 28 μA, which is close to that of bare ZnO NWs based device (21.4 μA). Simultaneously, the value of responsivity is 0.15, almost the same as the bare ZnO NWs based device. Considering that the value of absorption and the responsivity of this device remain almost the same as bare ZnO NWs based one, it is, therefore, believed that the enhancement of light absorption contributes to the increase of photocurrent. Moreover, as shown in Fig. R2 (b), the values of diffuse reflection of all the samples stay stable nearly at zero in the UV-A region. Based on above data, scattering effects can be neglected. Thus, we make a conclusion that it is the absorption of extra photons through surface plasmon resonance improves photoresponse.