Electronic Supplementary Information

Dual role of Ag nanowires in ZnO quantum dots/Ag nanowires hybrid channel photo thin film transistors

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Characterization of ZnO QDs

The photographs of colloidal ZnO QDs are shown in the Fig. S1. The ZnO QDs were clear and transparent. It illuminates yellow light under 365 nm UV, which is attributed to the oxygen vacancy defect.

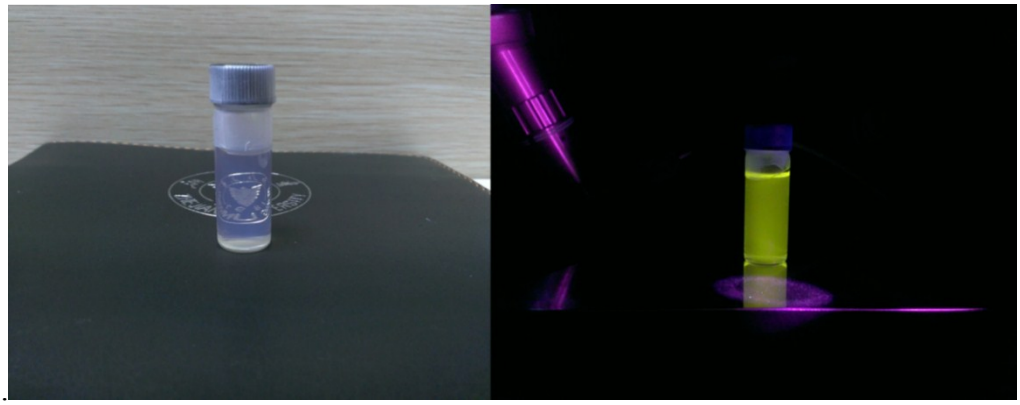

Fig. S1 (a) The photo of synthesized ZnO QDs and (b) under 365 nm illumination.

TEM study is presented in the article. The precipitated ZnO QDs powder without dispersed in ethanol is analyzed by X-ray diffraction (XRD) with a Cu Kα radiation source (λ = 1.54056 Å). The main peaks in the Fig. S2 are corresponding to the HRTEM diffraction rings in the Fig. 1b, confirming the formation of ZnO phase.

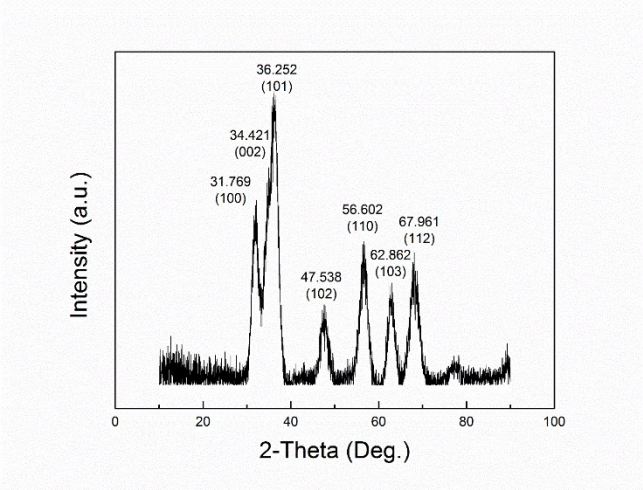

Fig. S2 XRD patterns of ZnO QDs.

The room temperature photoluminescence (PL) spectrum of the ZnO QDs deposited on quartz substrate is measured using an Edinburgh Instruments FLS-920 spectrometer with excitation wavelength fixed at 325 nm (Fig. S3). The PL spectrum of the ZnO QDs shows two bands. The band centered at 360 nm is the band-edge emission of ZnO, while another band centered at 562 nm is the parasitic green emission originating from the transition between electrons close to the conductive band and deeply trapped holes at VO^{++}. The blue shift of band-edge emission confirms the quantum confinement effect of QDs. The strong intensity of the green emission as compared to the band-edge emission indicates a high density of hole-traps in the as-prepared ZnO QDs, which helps to prolong the carrier life-time of photo-generated holes. The absorption spectrum of the ZnO QDs is measured with a Shimadzu UV-3600 spectrophotometer and shown in Fig. S4. The sharp cutoff wavelength at 360 nm agrees with the photoluminescence measurement.

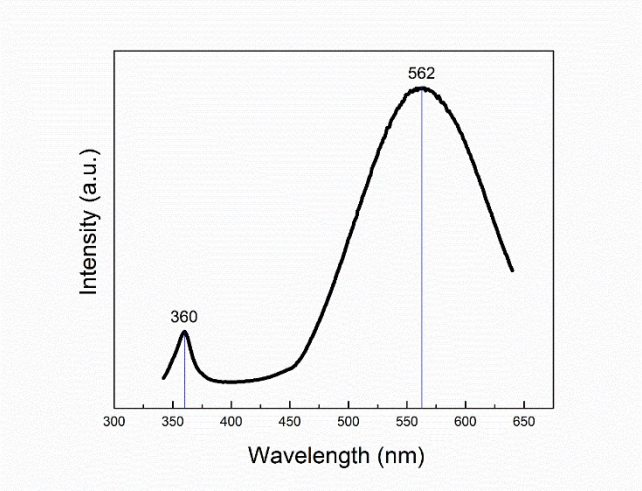

Fig. S3 Room temperature PL spectrum of ZnO QDs.

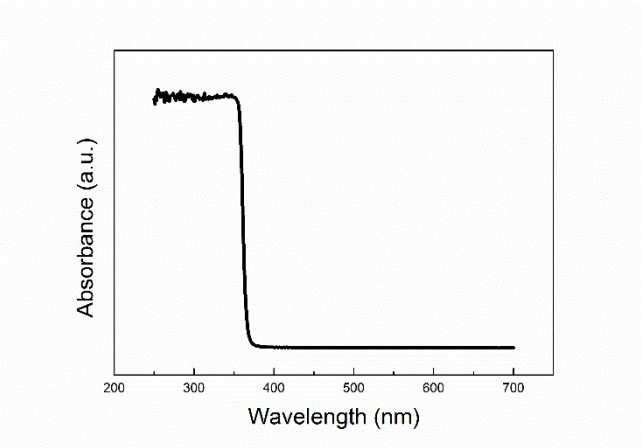

Fig. S4 Absorption spectrum of ZnO QDs.

Output characteristic of ZnO QDs/Ag NWs hybrid channel TFTs

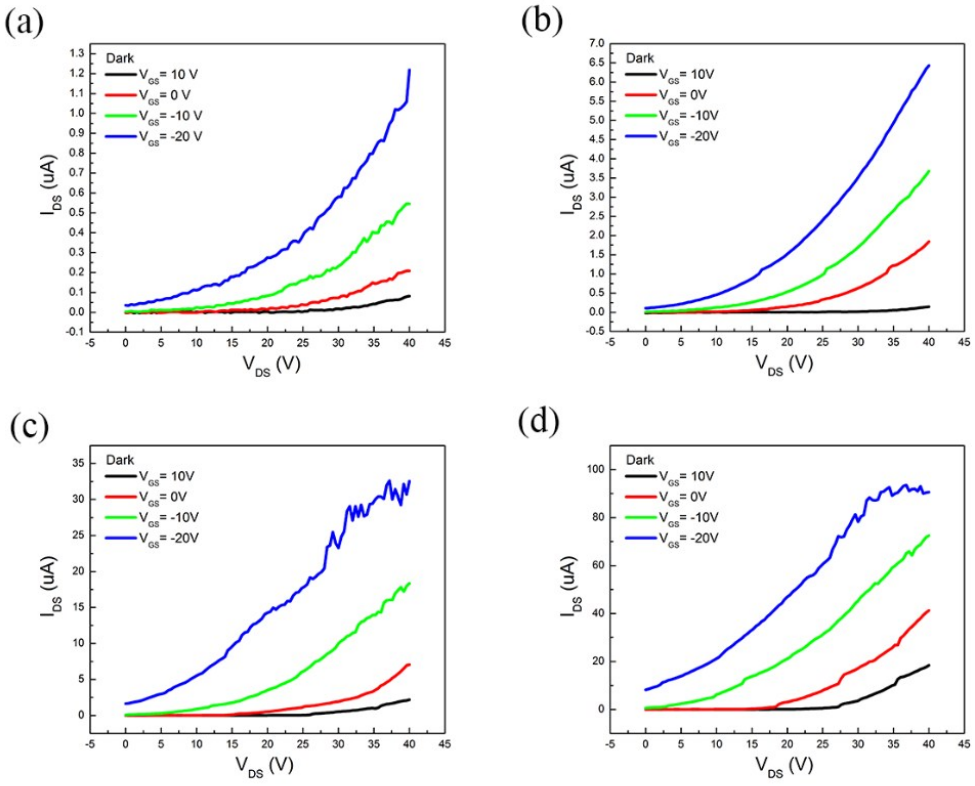

Fig. S5 The output curves of ZnO QDs/Ag NWs hybrid channel TFTs at different annealing temperature (a) 100 °C, (b) 150 °C, (c) 200 °C, (d) 300 °C.

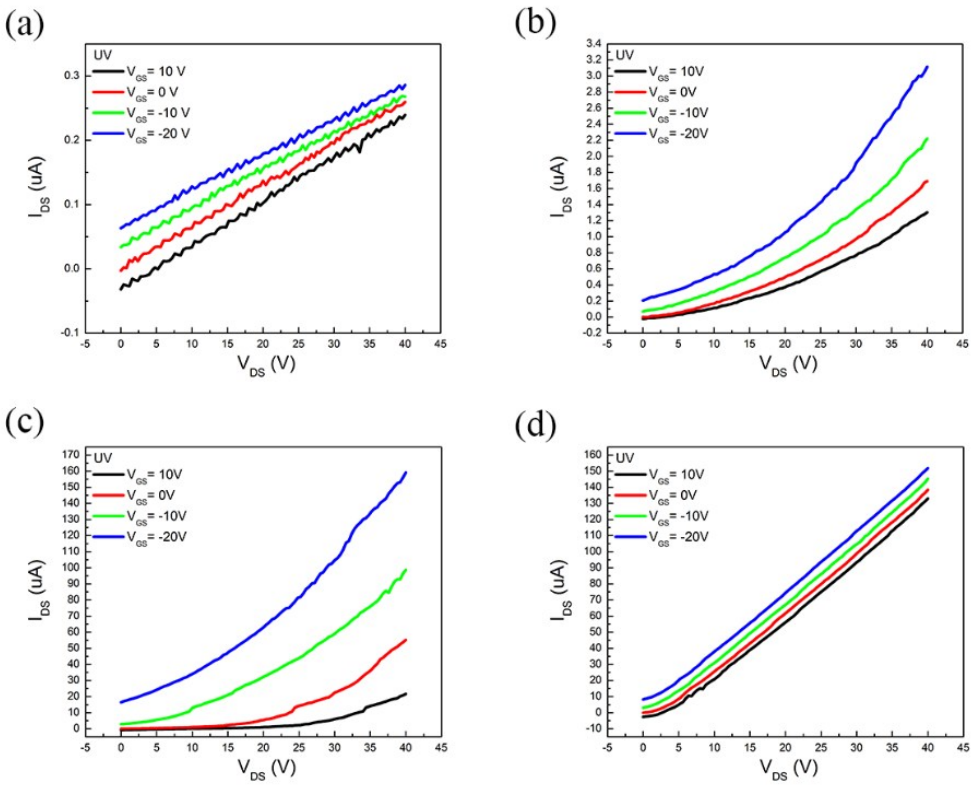

Fig. S6 The output curves of ZnO QDs/Ag NWs hybrid channel TFTs under 365 nm UV illumination at different annealing temperature (a) 100 °C, (b) 150 °C, (c) 200 °C, (d) 300 °C.

The transfer characteristics of ZnO QDs without Ag NWs annealed at 100 °C

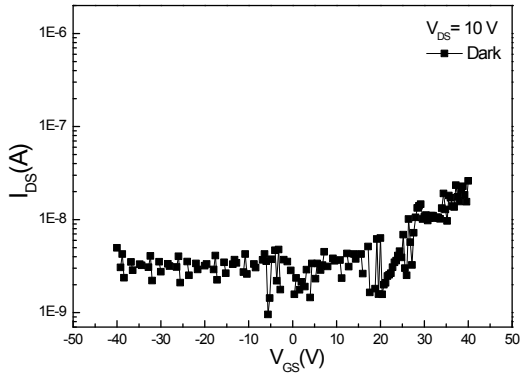

Fig. S7 The transfer characteristics of ZnO QDs without Ag NWs.