

Supporting Information

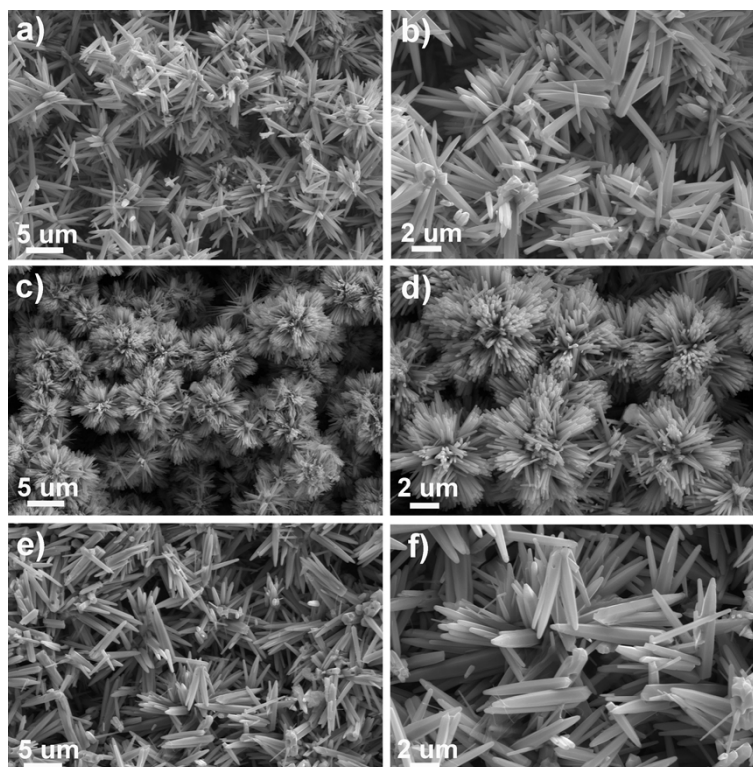


Fig. S1 Typical SEM images of ZnO prepared on ITO substrate with different concentration of NaOH in 12 h: (a, b) 0.35 M NaOH; (c, d) 0.45 M NaOH; (e, f) 0.65 M NaOH

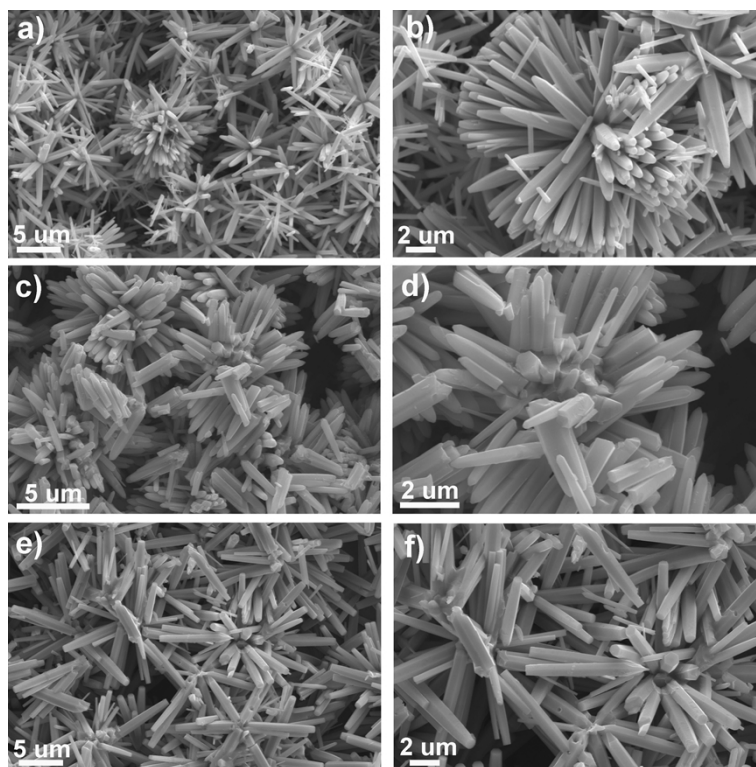


Fig. S2 Typical SEM images of ZnO prepared on ITO substrate with different concentration of NaOH in 24 h: (a, b) 0.35 M NaOH; (c, d) 0.45 M NaOH; (e, f) 0.65 M NaOH

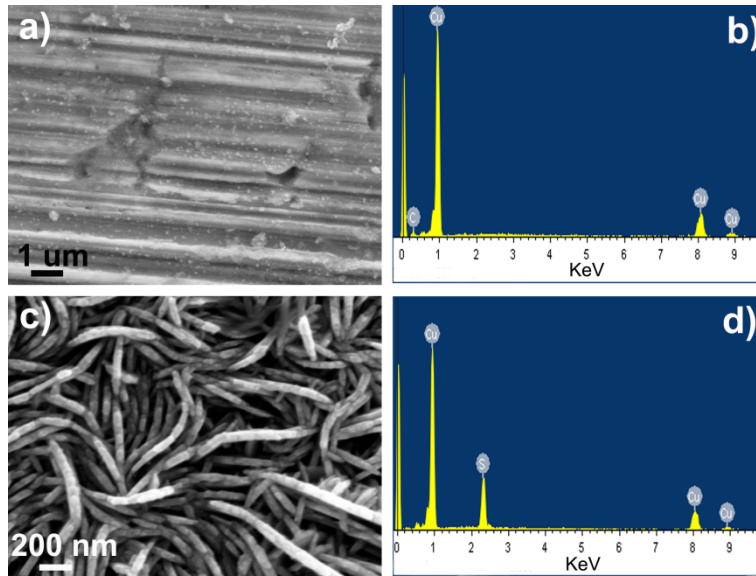


Fig. S3 (a) SEM image and (b)EDS spectrum of brass sheet, (c,) SEM images and (d)EDS spectrum of Cu_2S counter electrode.

Fig. S3a, S3c show the SEM images of brass sheet and Cu_2S counter electrode, respectively. EDS spectra of (b) brass sheet,, (d) 12h $\text{ZnO}/8\text{CdS}$, and (f) Cu_2S counter electrode. Fig. S3a shows a rough surface of brass sheet. EDS spectrum of brass sheet is shown in Fig. 5b, which include carbon, and cuprum chemical components. Compare with Fig. S3a, there are many uniform worm-like Cu_2S morphology based on brass sheet substrate shown in Fig. S3c. EDS spectrum of Cu_2S counter electrode is shown in Fig. S3d, which includes carbon, sulfur, and cuprum chemical components. The presence of sulfur and cuprum element in Fig. S3d indirectly indicates that formation of Cu_2S counter electrode.

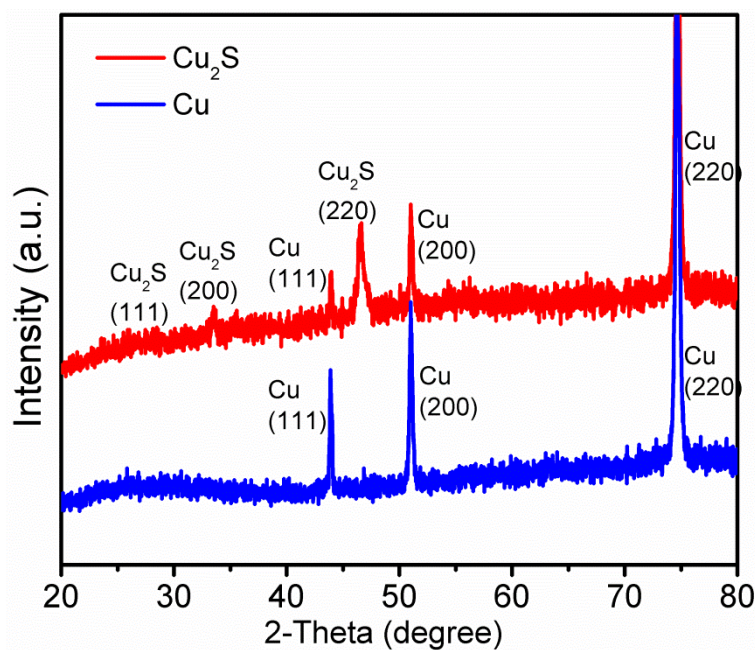


Fig. S4 XRD patterns of brass sheet and Cu_2S counter electrode.

To confirm the structure of the Cu_2S counter electrode, the XRD patterns are represented in Fig. S4. The diffraction pattern of brass sheet is fitted well with the bulk cubic crystal system Cu single phase. Three obvious diffraction peaks located at 43.8° , 51° , and 74.6° , can be observed in all patterns of the brass sheet, which well agrees with Cu structure (111), (200), and (220) plane, respectively (JCPDS No.65-9743). Compared with the XRD patterns of the brass sheet, the diffraction patterns of Cu_2S counter electrode shown in Fig. S4 are also fitted well with the bulk cubic Cu_2S single phase. Three obvious diffraction peaks located at 27.8° , 32.5° , and 46.5° , which well agrees with cubic Cu_2S structure (111), (200), and (220) plane, respectively (JCPDS No.253-0522). The X-ray diffraction results shown in Fig. S4 is well agrees with the EDS spectra shown in Fig. S3.

From Fig S5 and Fig S6, we can see that the Nyquist impedance plots (red) of 8CdS/ZnO and 3CdSe-8CdS/ZnO QDSCs are nearly coincident with the fitted curve (green). In Fig 7, R_s is the series resistance, which is related to the intercept of horizontal axis. R_{CE} is the charge-transfer resistance at the counter electrode-electrolyte interface, which is fitted from the left semicircle in Fig 7. $R_{\text{rec-ZnO}}$ is the recombination resistance at the photoanode-electrolyte interface, which is fitted from the right semicircle

in Fig 7.

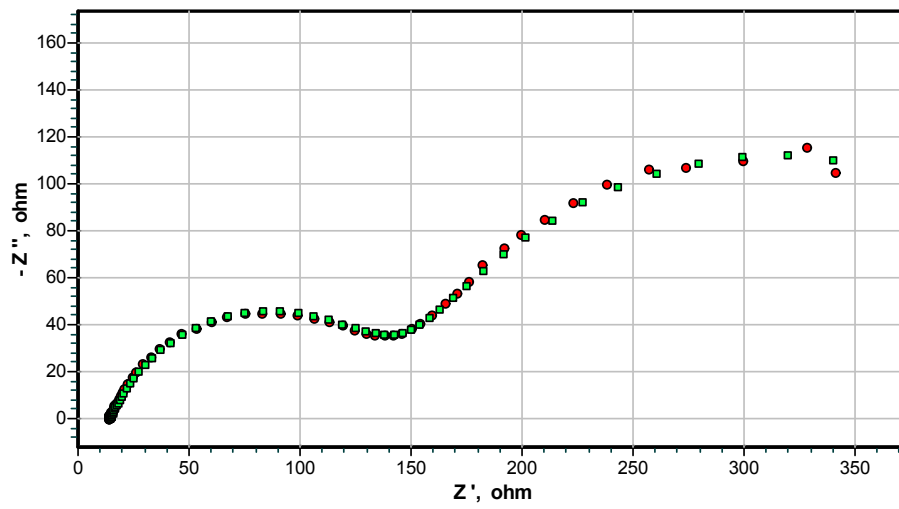


Fig. S5 Nyquist impedance plots (red) and fitted curve (green) under one-sun irradiation of 8CdS/ZnO QDSCs.

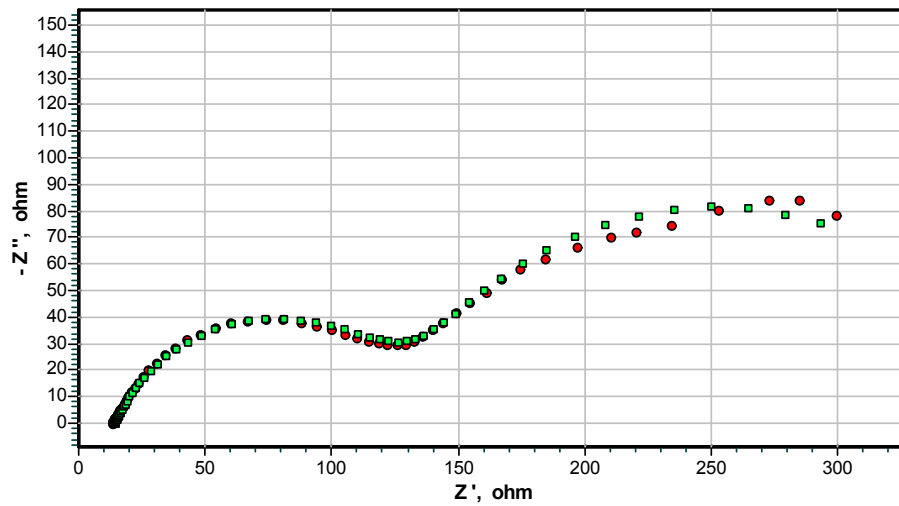


Fig. S6 Nyquist impedance plots (red) and fitted curve (green) under one-sun irradiation of 3CdSe-8CdS/ZnO QDSCs.