Suppressing Interface Recombination in CZTSSe Solar Cells by Simple Selenization with Synchronous Interface Gradient Doping

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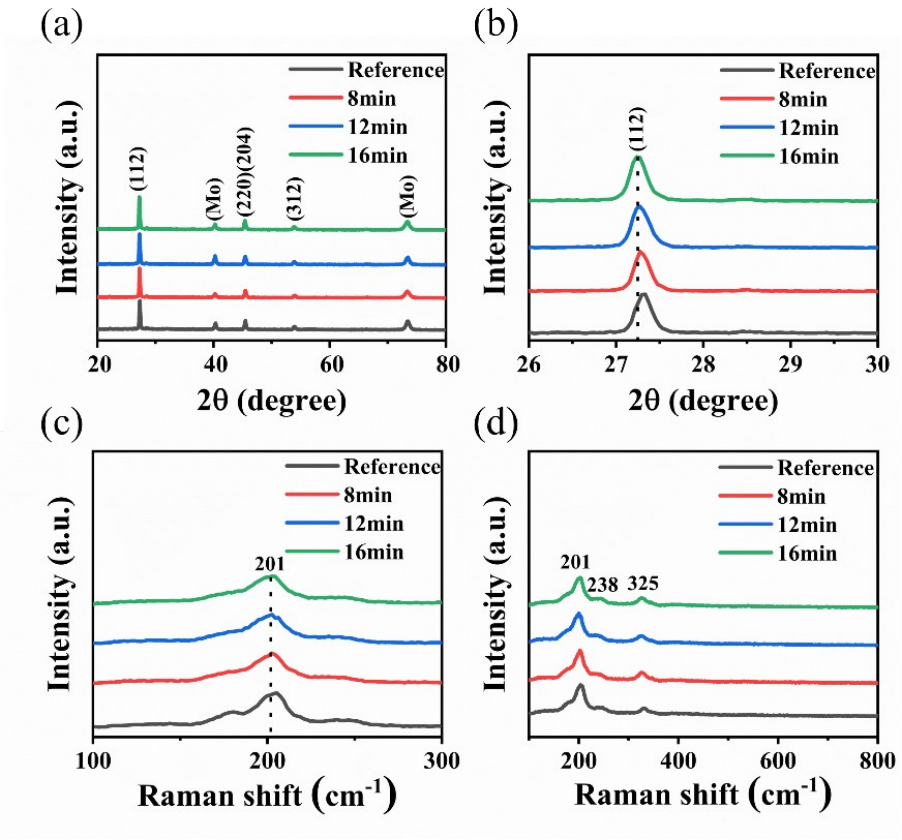

Figure S1. XRD patterns (a) and enlarged (112) peak (b) of CZTSSe absorber with/without Cd gradient doping; Raman spectra (c) and enlarged peak at 201 cm^{-1} (d) of the CZTSSe absorber with/without Cd gradient doping.

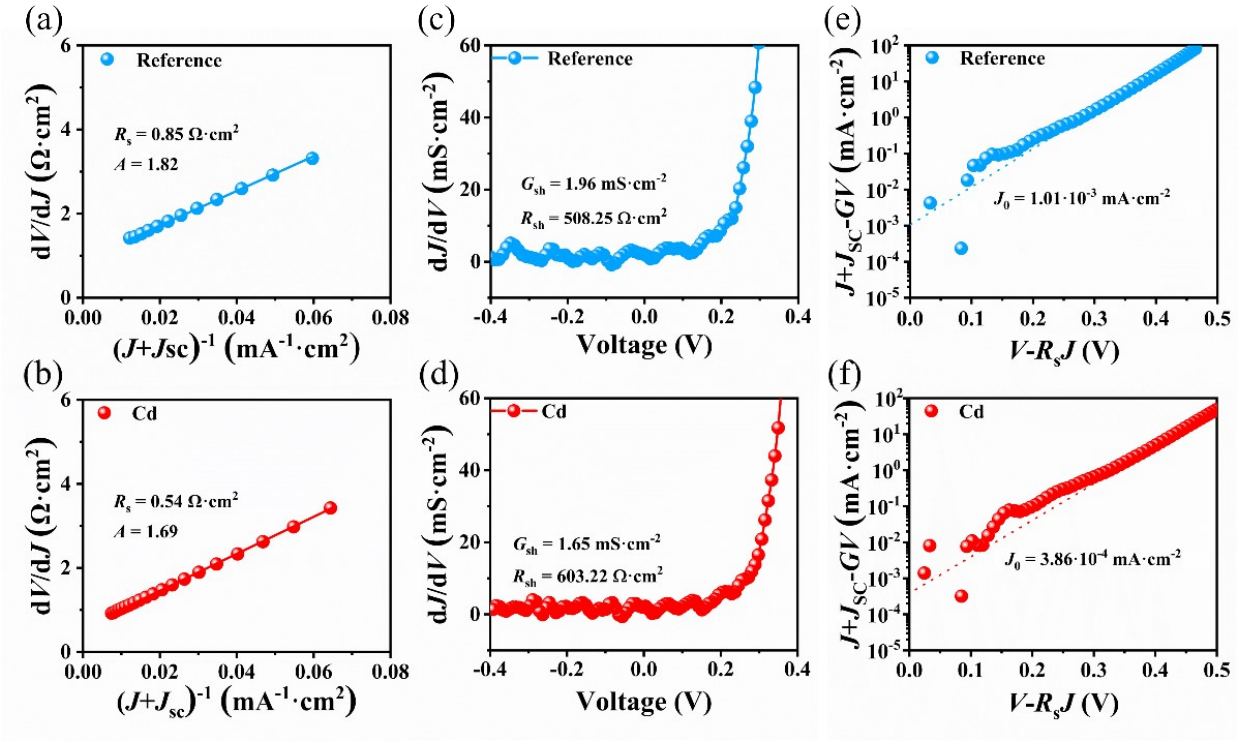

Figure S2. dV/dJ vs $(J+J_{sc})^{-1}$ plots used to determine R_S and A (a)-(b); dJ/dV vs V curves used to calculate G_{Sh} and R_{Sh} (c)-(d); $J+J_{sc}$-GV vs V-R_sJ plots used to obtain J_0. All plots are deduced from the J-V curves.

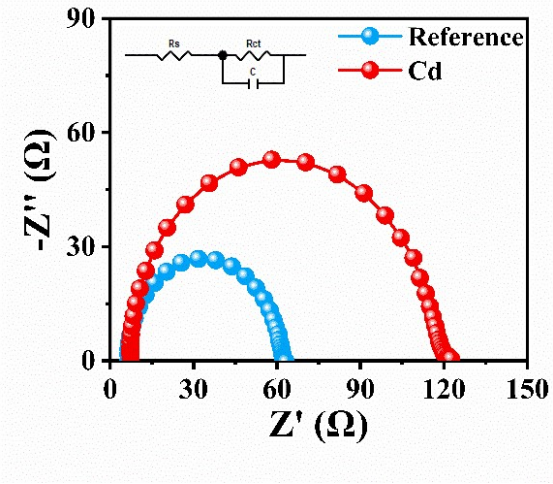

Figure S3. Nyquist plots of CZTSSe device with/without Cd gradient doping obtained at -0.4 V bias.