Supporting Information

Tandem solar cells from solution-processed CdTe and PbS quantum dots using a ZnTe/ZnO tunnel junction

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Fig. S1. CdTe films of three different thicknesses used as optical filters on conductive glass.

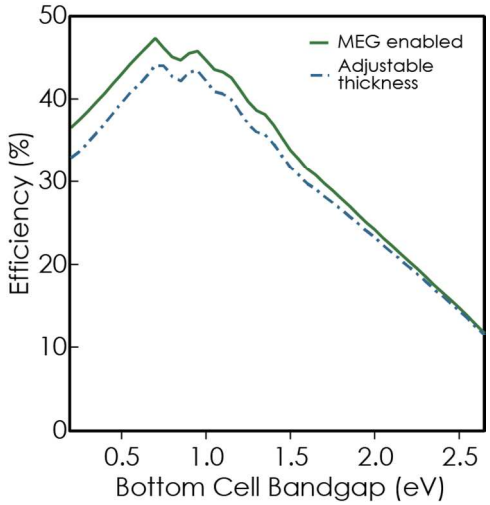

Fig. S2. Detailed balance calculation of the maximum achievable efficiency for dual junction tandem solar cells with the top cell bandgap set to 1.5 eV with variable thickness. The green trace shows the maximum achievable efficiency if the layers could undergo multiple exciton generation and produce more than one carrier per photon when energetically allowed.

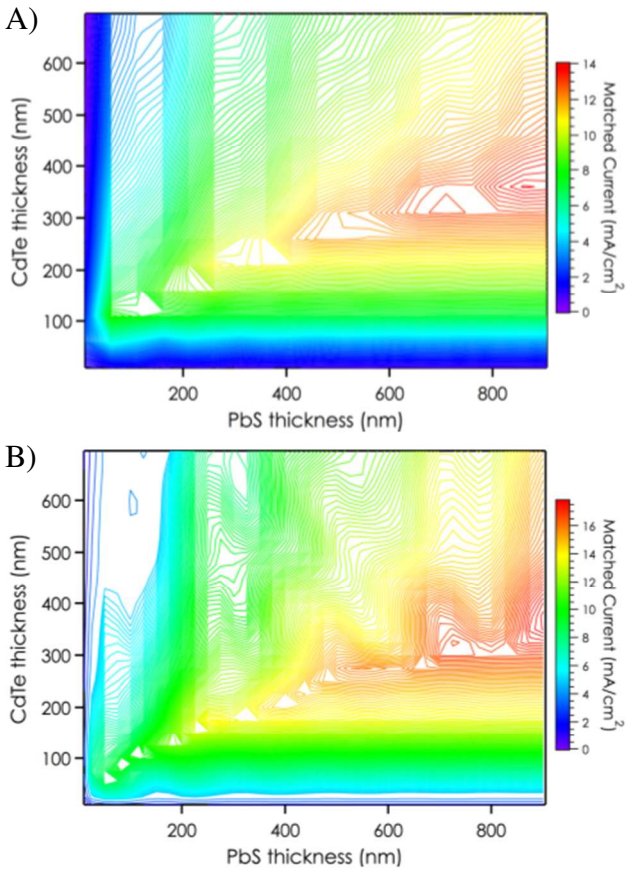

Fig. S3. (a) Optical modeling results for the tandem structure that is shown in Fig. 3a plotted as a function of the CdTe and PbS thicknesses on the y- and x-axes respectively with the color showing the expected current output of a 2-terminal tandem. The matched current reaches a peak of 14 mA/cm^2 for thicknesses of 350 nm and 700nm for the CdTe and PbS, respectively. (b) Optical modeling results for the structure shown in Fig. 3b. The matched current reaches a peak of ~17 mA/cm^2 for thicknesses of 325 nm and 750 nm for the CdTe and PbS, respectively.

Median Performance Characteristics for Figure 4A (Varying CdTe Thickness)					
	J_{SC} (mA/cm^2)	V_{OC} (V)	FF (%)	PCE (%)	High PCE (%)
150 nm	6.83	1.03	44	3.1	3.2
200 nm	6.88	0.92	45	2.9	3.0
250 nm	7.91	1.08	48	4.1	4.9
300 nm	7.40	1.11	46	3.8	3.8
400 nm	7.00	1.13	51	4.1	4.4

Table S1: Median performance characteristics are shown for PbS/CdTe tandem devices shown in Figure 4A. The CdTe thickness is varied from 150 to 400 nm as the PbS thickness is held constant at ~300 nm.

Tandem Performance Characteristics for Figure 4C (Varying PbS Thickness)					
	J_{SC} (mA/cm^2)	V_{OC} (V)	FF (%)	PCE (%)	High PCE (%)
300 nm	7.90	1.08	47	4.0	4.9
400 nm	8.74	1.08	46	4.3	4.4
500 nm	9.32	1.08	45	4.5	4.7

Table S2: Median performance characteristics are shown for PbS/CdTe tandem devices shown in Figure 4C. The PbS thickness is varied from 300 to 500 nm as the CdTe thickness remains constant at ~250 nm.

Performance Characteristics from Figure 5A					
	J_{SC} (mA/cm^2)	V_{OC} (V)	FF (%)	PCE (%)	High PCE (%)
PbS Control	26.1	0.461	44.4	5.3	5.6
CdTe Control	14.1	0.536	54.5	4.1	5.2
Tandem	9.9	1.06	45	4.7	

Table S3: Performance characteristics are shown the PbS control, CdTe control, and the PbS/CdTe tandem device shown in Figure 5A.