Supporting information for:

Mid-IR Narrow Bandgap Silver Mercury Telluride Alloy Semiconductor Nanocrystal for Self-powered Mid-IR Photodiode

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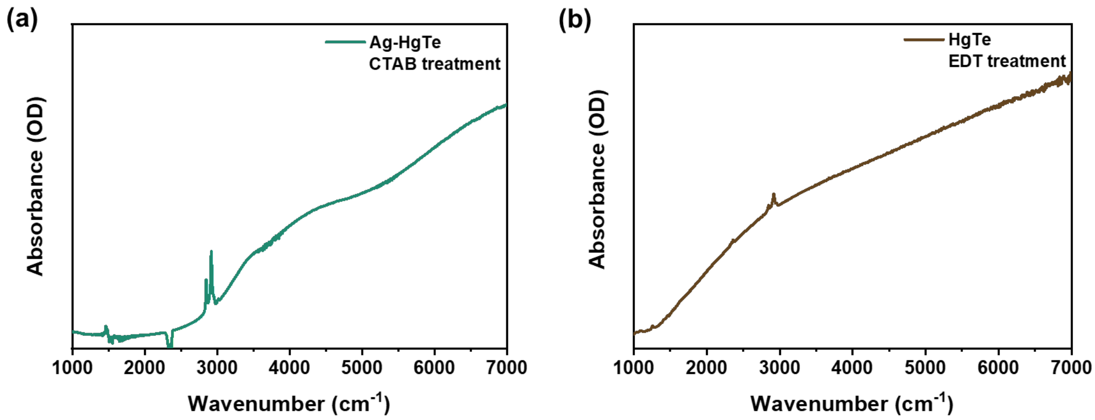

Figure S1. Absorption spectra of Ag-HgTe and HgTe NCs after exchanging the ligand.

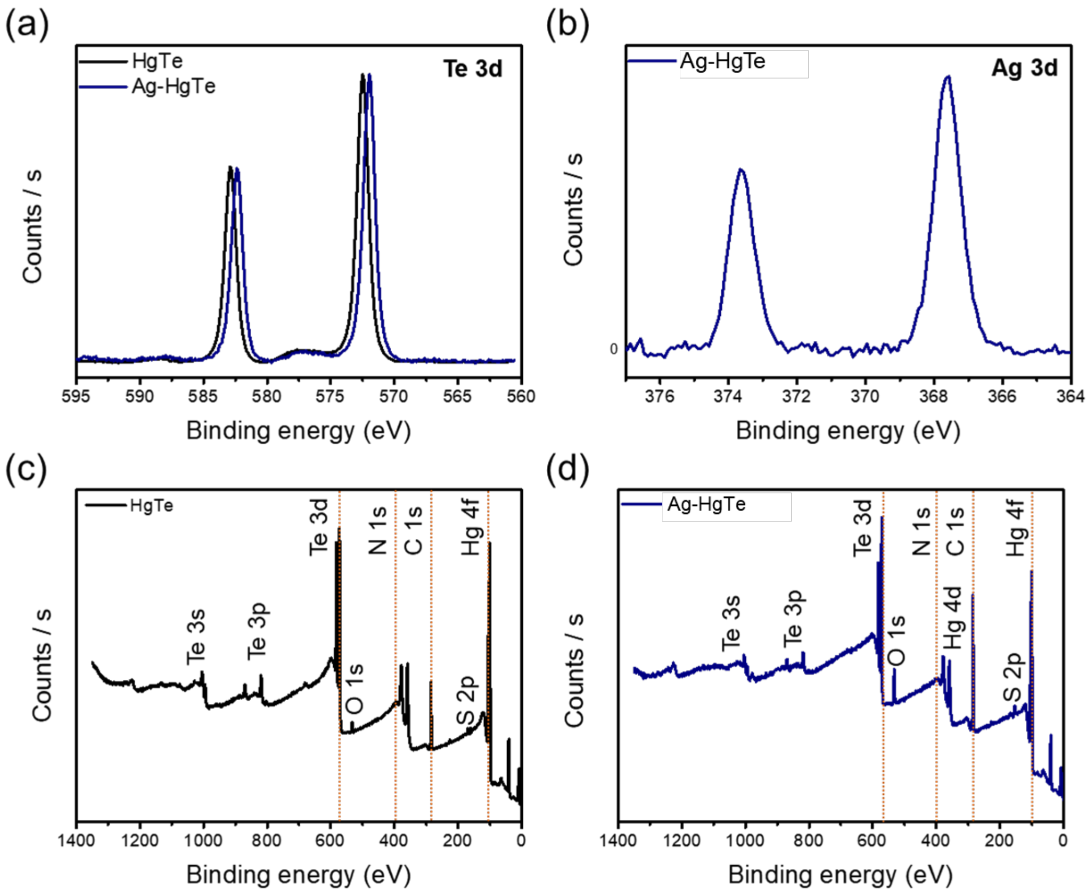

Figure S2. XPS spectra of HgTe (left) and Ag-HgTe NCs (right). (a) Te 3d scan (b) Ag 3d (c), (d) survey scans.

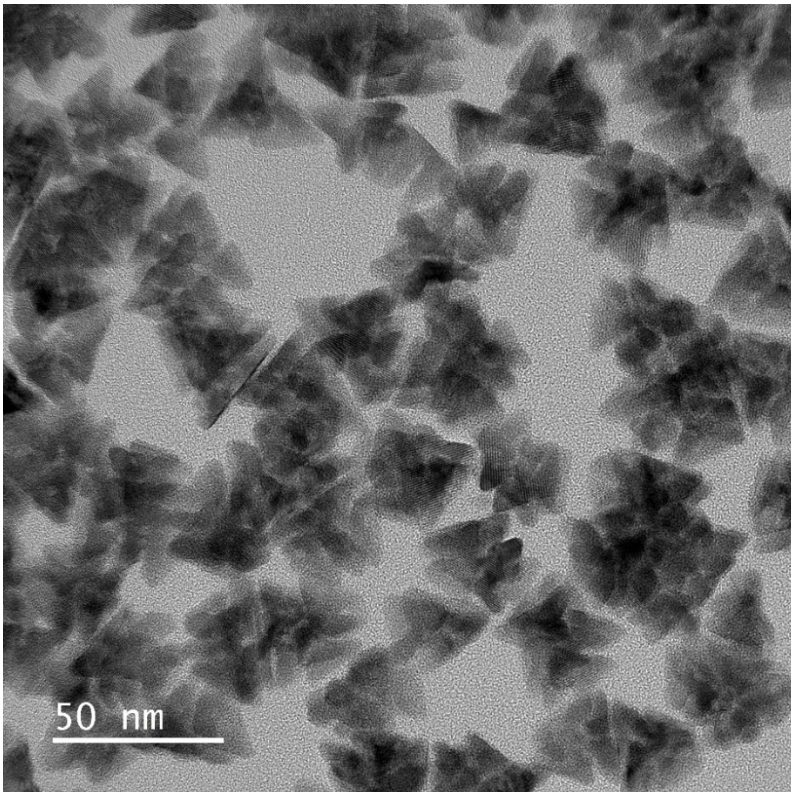

Figure S3. TEM image of HgTe NCs.

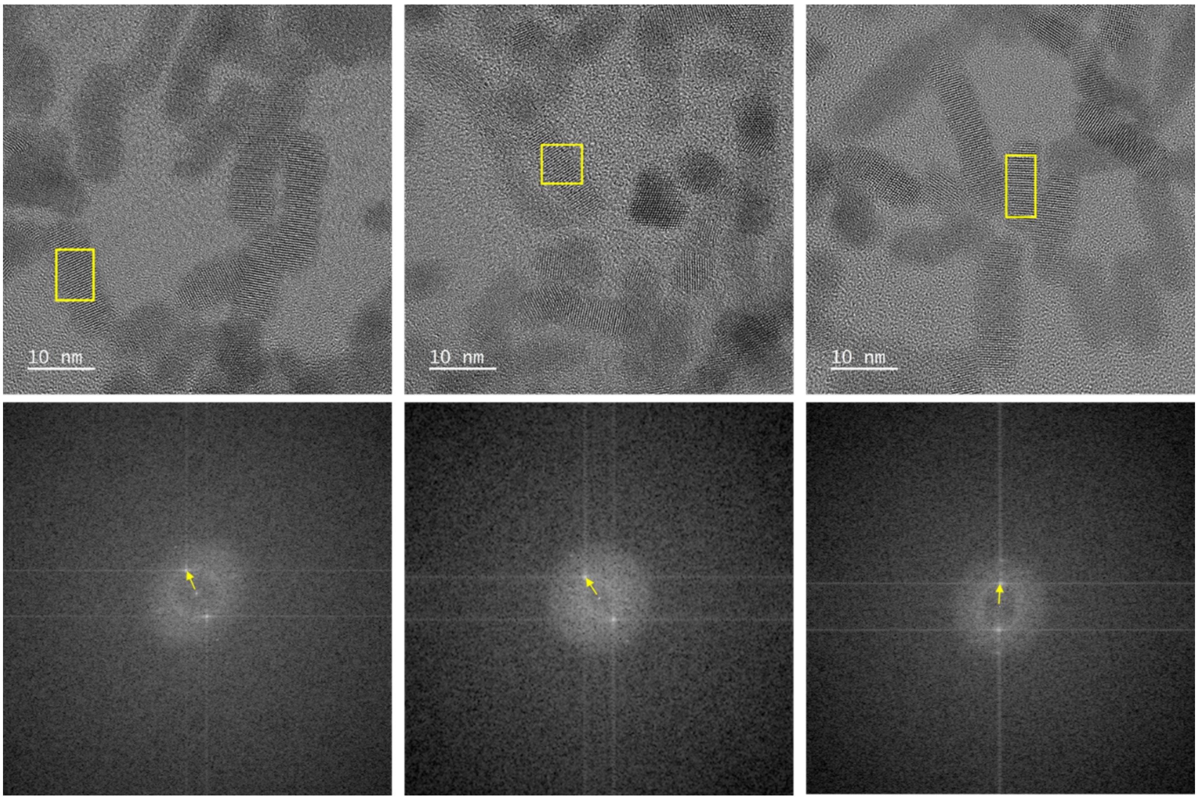

Figure S4. TEM images (above) and the corresponding FFT analysis (below) of Ag-HgTe NCs. Interplanar distance indicated by a yellow arrow is measured to be 3.7 Å in each image, which corresponds to (111) facet of cubic HgTe phase.

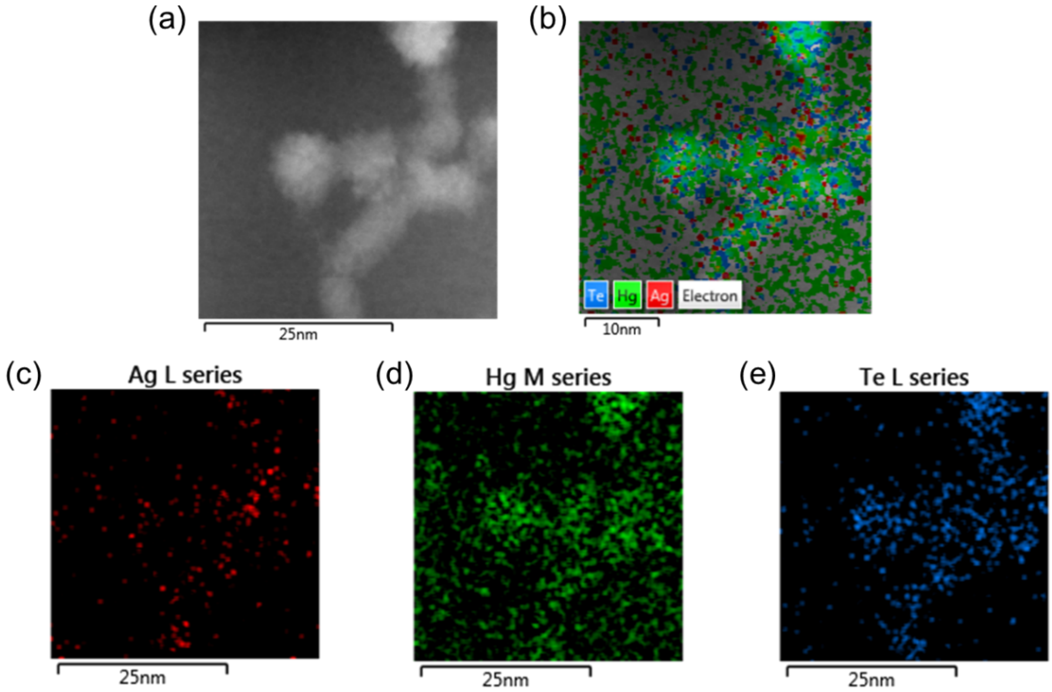

Figure S5. EDS element mapping of Ag-HgTe NCs.

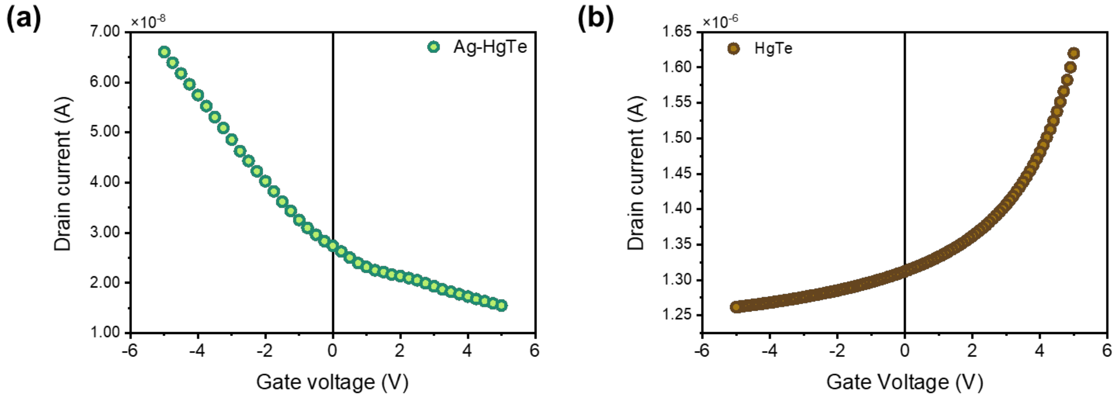

Figure S6. Drain current-gate voltage (I_d-V_g) characteristic of Ag-HgTe NCs.

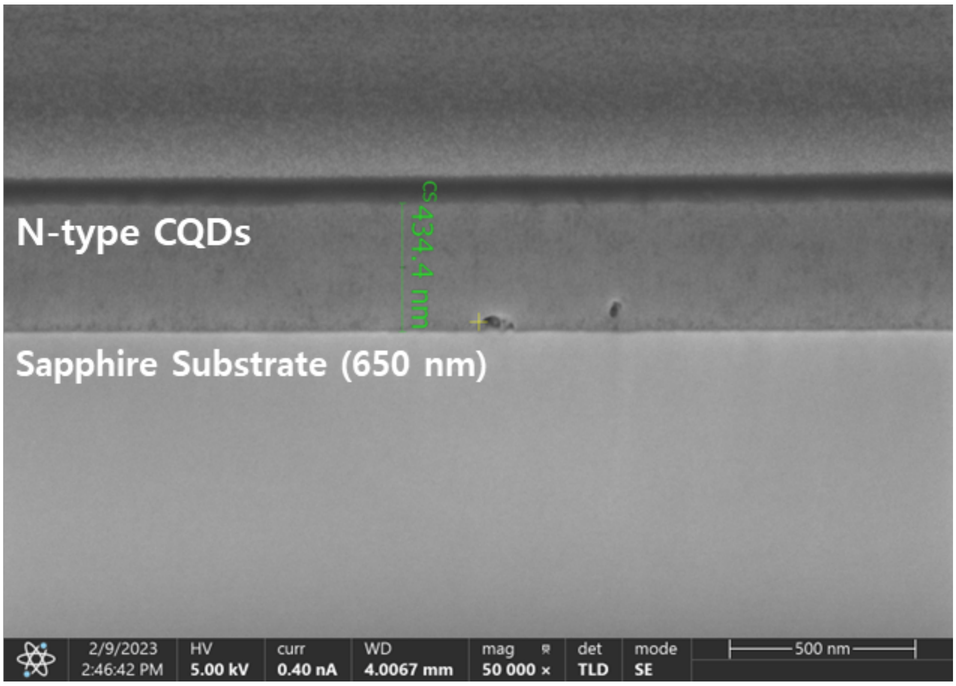

Figure S7. Cross-sectional FIB image of only HgTe NCs deposited film on the sapphire substrate.

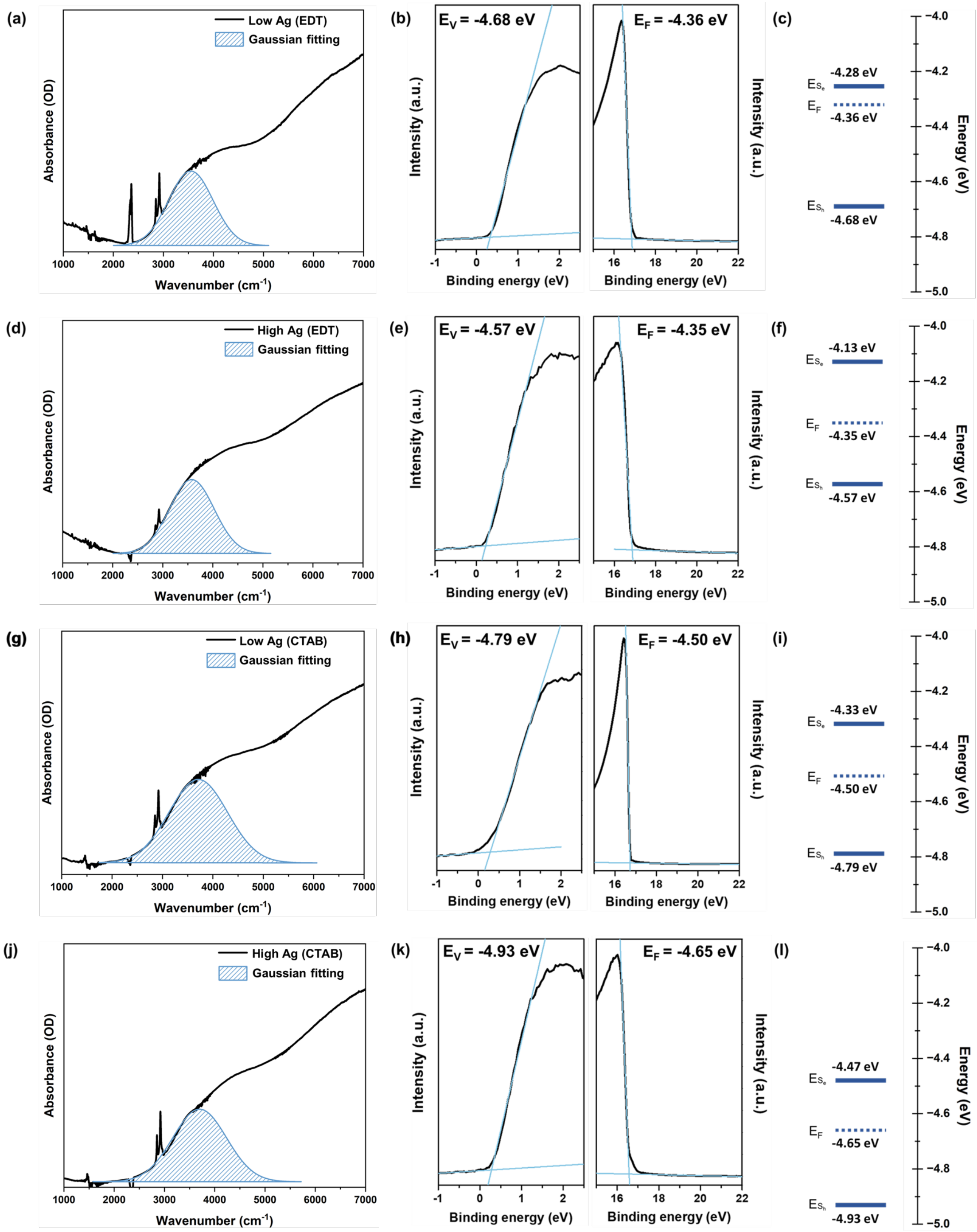

Figure S8. (a), (d), (g) (j) FT-IR spectra with Gaussian fitting, (b), (e), (h), (k) low (left) and high (right) binding energy region of UPS spectra, and (c), (f), (i), (l) energy level of Ag-HgTe NCs.

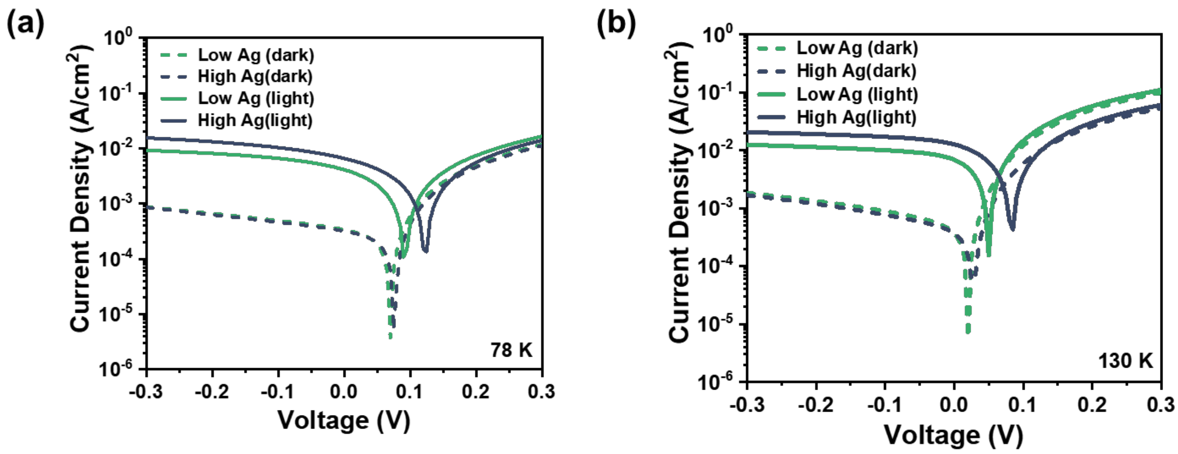

Figure S9. J-V curves of the HgTe NC detector with High and Low Ag-HgTe NC layers under dark (dashed line) and light (solid line, 300 ℃ blackbody radiation) at (a) 78 K and (b) 130 K.

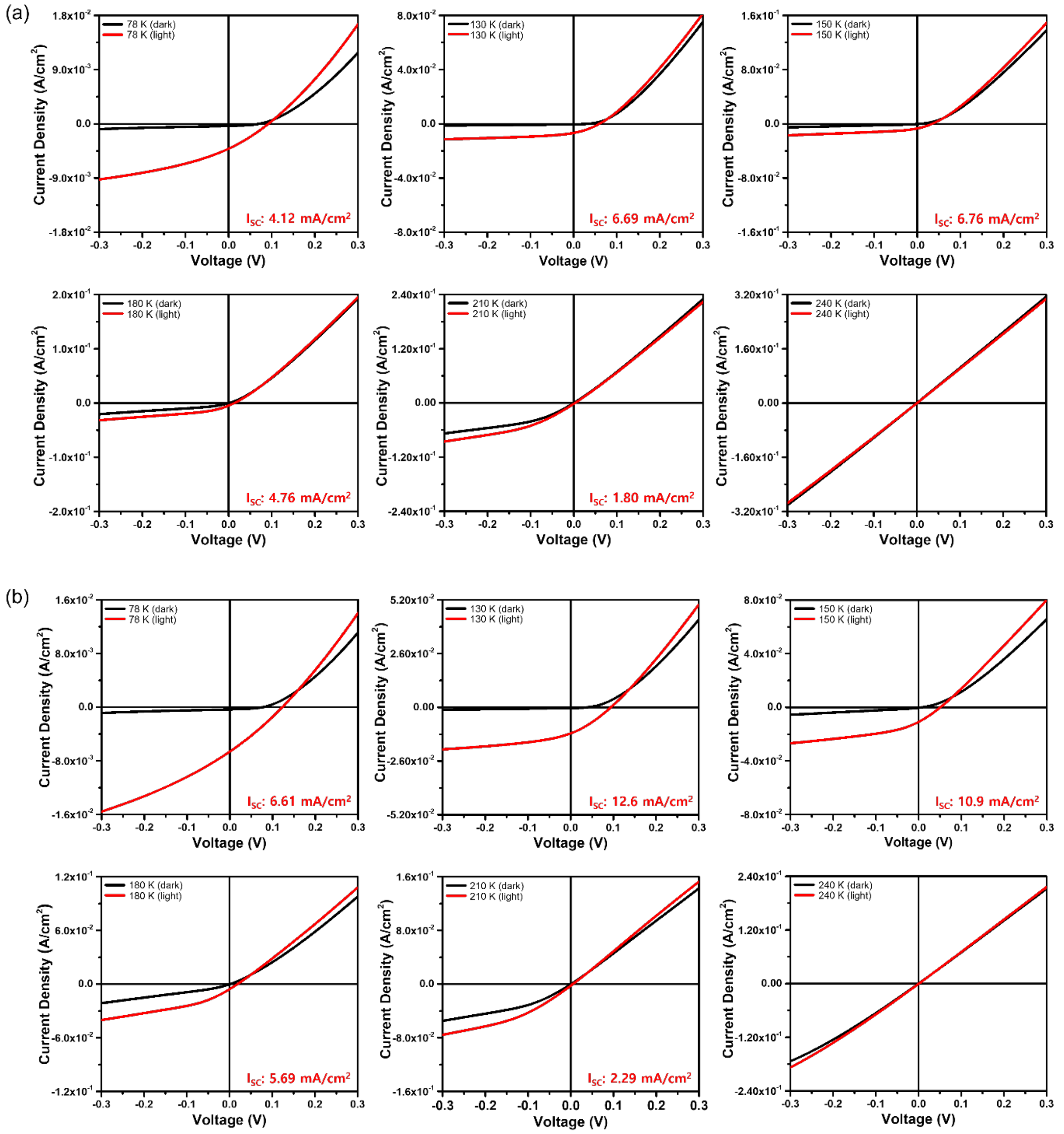

Figure S10. J-V characteristics of the HgTe NC detectors with different Ag:Hg atomic ratios in Ag-HgTe NC layer with increasing the temperatures from 78 K to 240 K. (a) Low Ag and (b) High Ag-HgTe NCs.

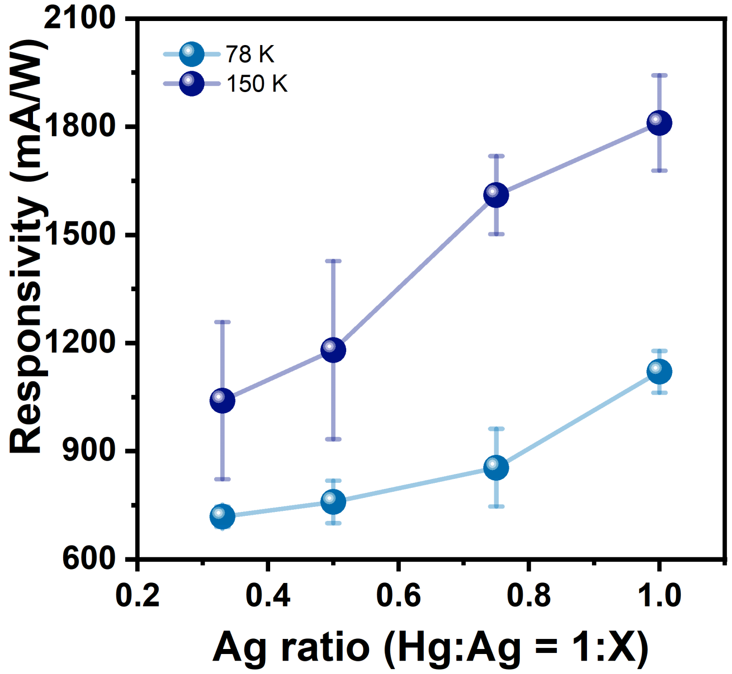

Figure S11. Responsivity of the HgTe NC detectors depending on the Hg:Ag precursor ratios in the Ag-HgTe NC layer.

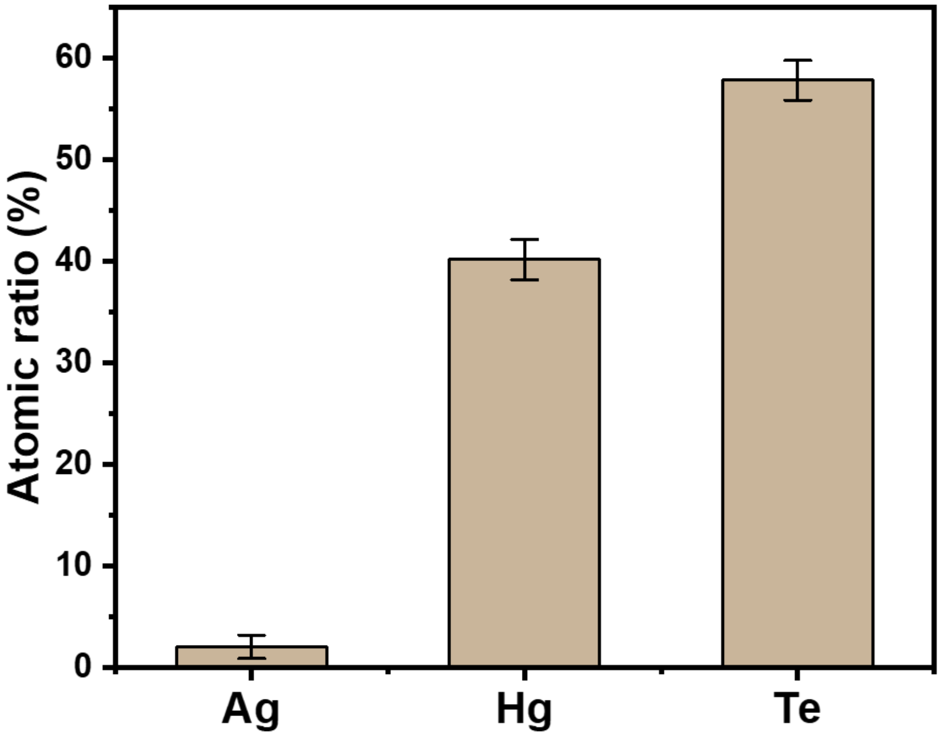

Figure S12. The alloy composition (atomic percent) in Ag-HgTe NCs was analyzed by ICP-MS measurement.

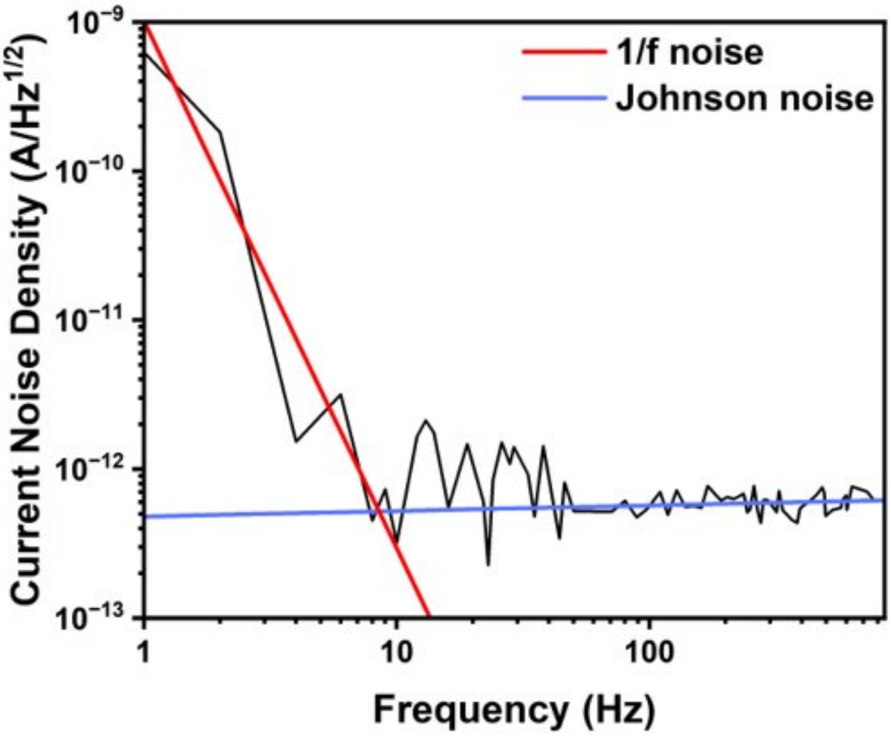

Figure S13. Noise density spectrum of the CTAB-treated device at 78 K. The spectral noise density was 0.52 $pA/Hz^{1/2}$.

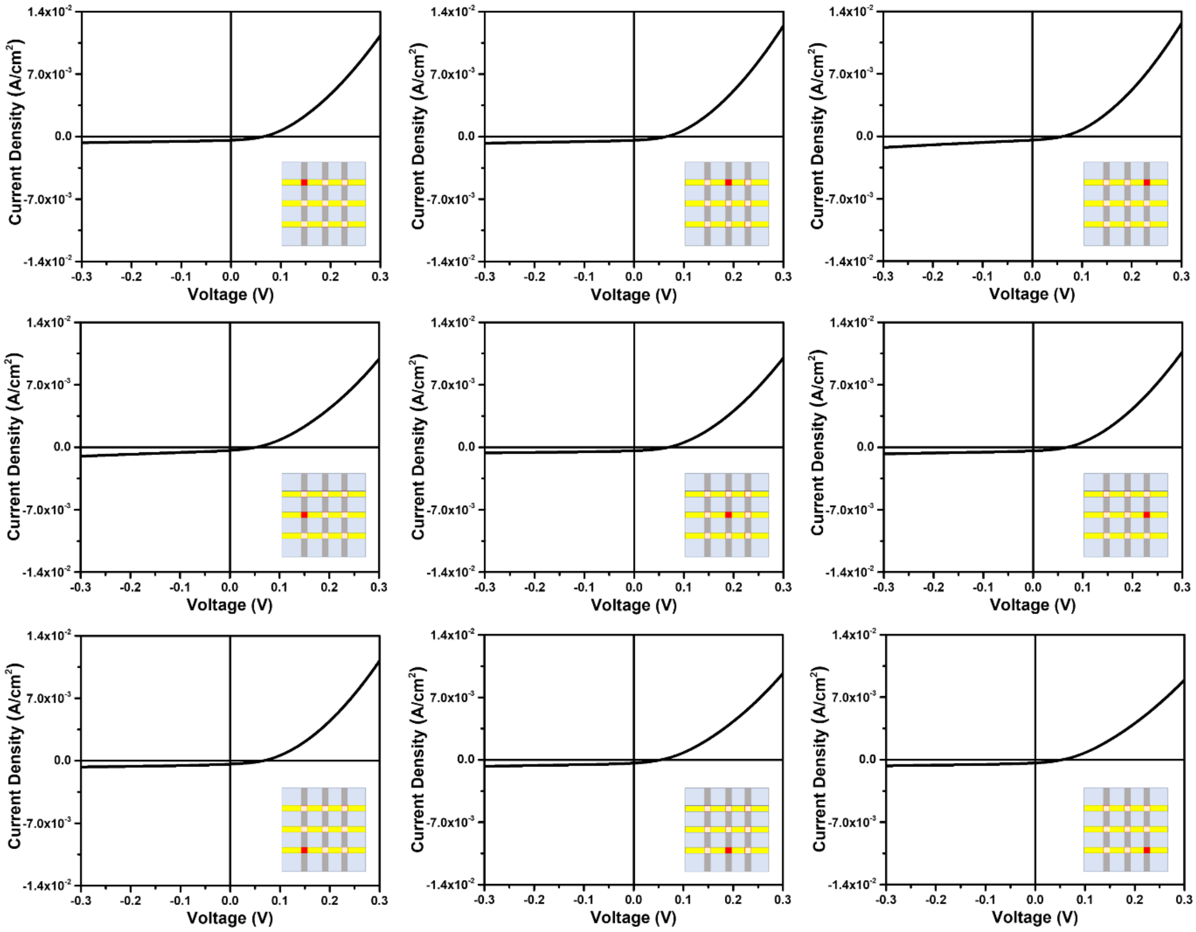

Figure S14. J-V characteristics in one device illuminated by the blackbody radiation of 20 °C. The active area for each cell is 1.05 mm^2.

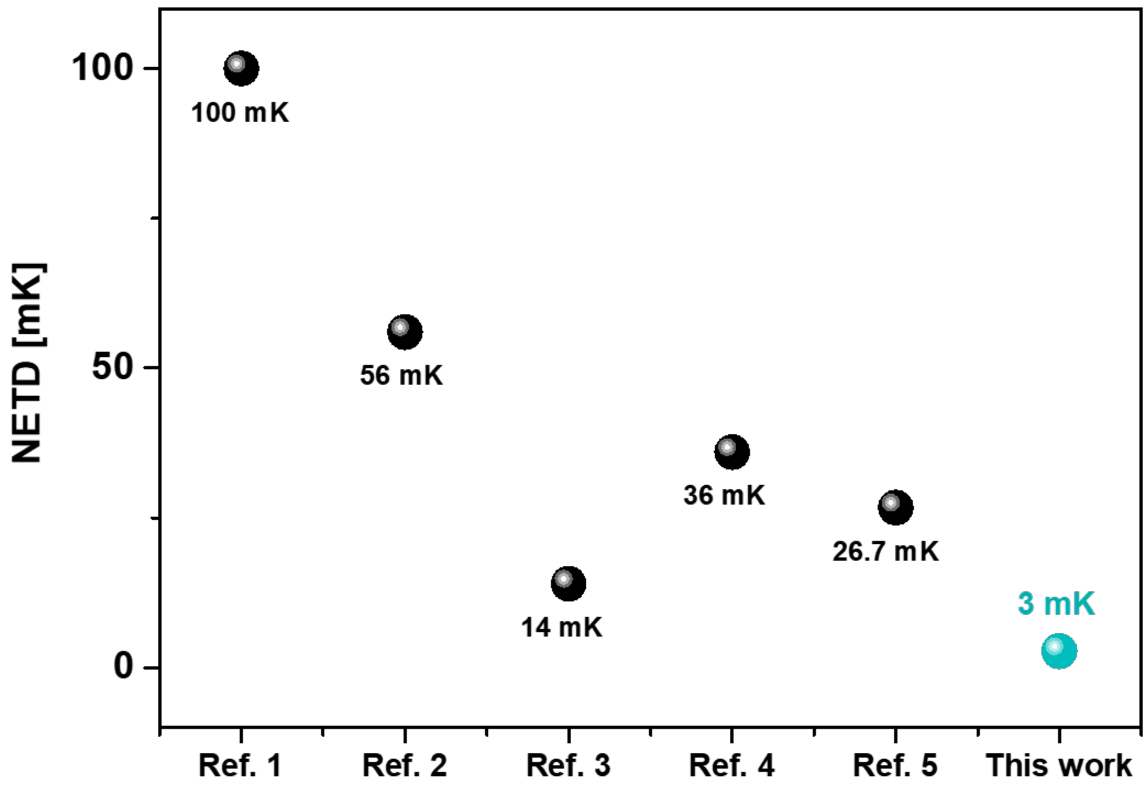

Figure S15. NETD value comparison of the HgTe CQDs-based photodetectors.

Reference

[1] C. Buurma, R. E. Pimpinella, A. J. Ciani, J. S. Feldman, C. H. Grein, P. Guyot-Sionnest, Devices Appl.2016, 9933, 993303

[2] M. M. Ackerman, X. Tang, P. Guyot-Sionnest, *ACS Nano* **2018**, *12*, 7264.

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