Supporting information

Rapid Microwave-Assisted Synthesis and Characterization of a Novel CuCoTe Nanocomposite Material for Optoelectronic and Dielectric Applications

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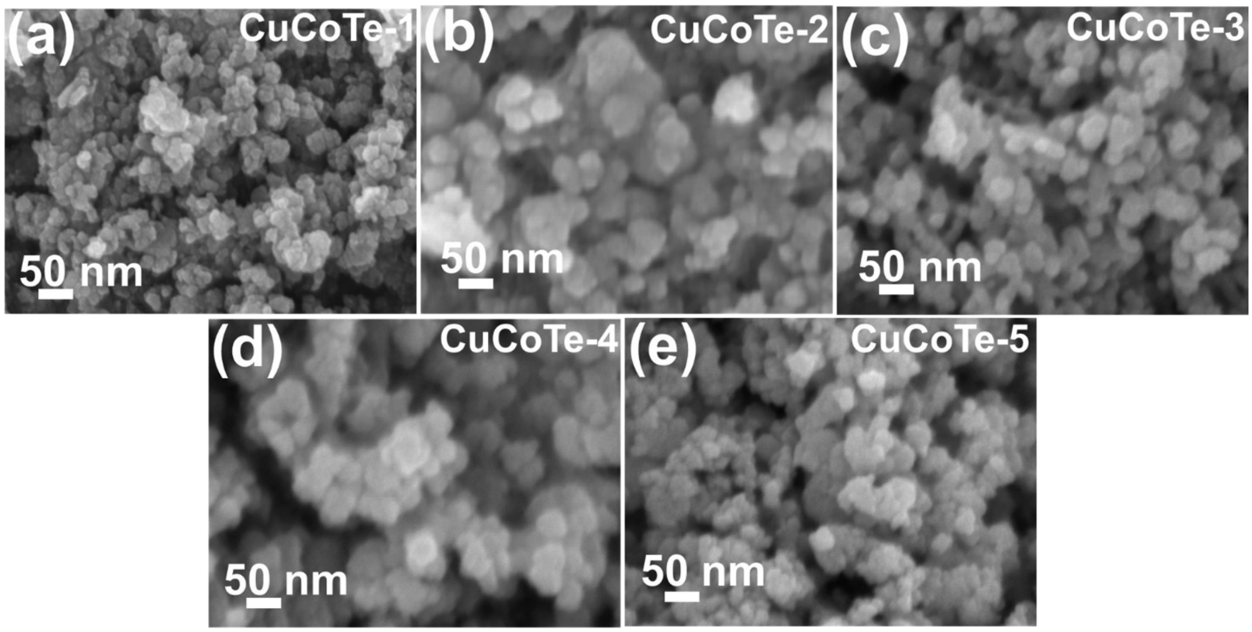

Fig. S1 FESEM images of CuCoTe nanocomposites (a) CuCoTe-1, (b) CuCoTe-2, (c) CuCoTe-3, (d) CuCoTe-4, and (e) CuCoTe-5 at 50 nm (synthesized at 180 W).

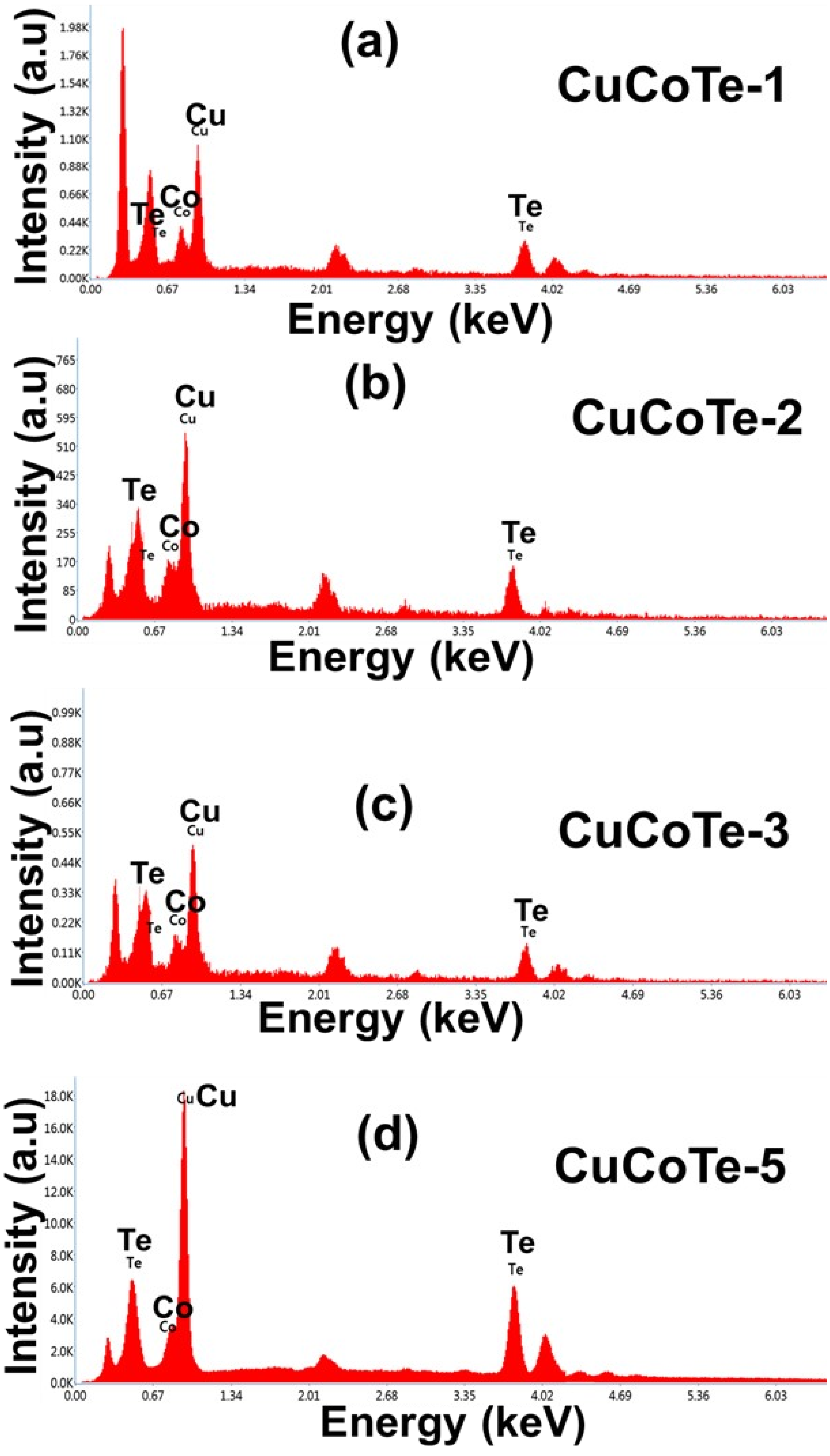

Fig. S2 EDX spectra of CuCoTe nanocomposites (a) CuCoTe-1, (b) CuCoTe-2, (c) CuCoTe-3, and (d) CuCoTe-5 (synthesized at 180 W).

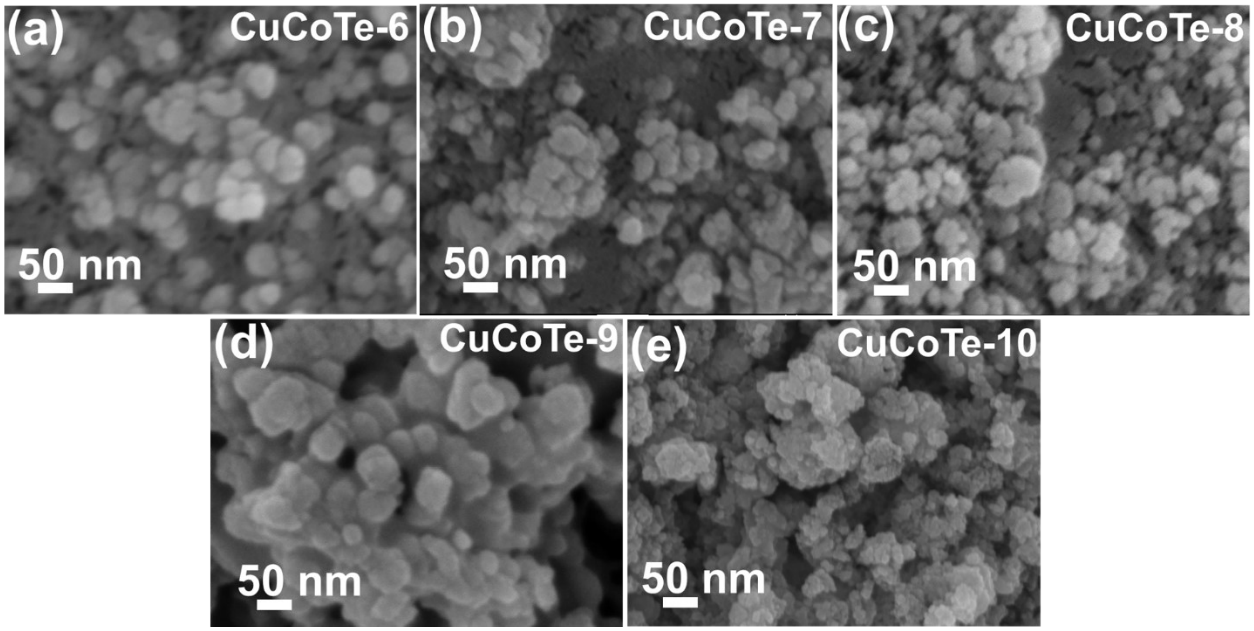

Fig. S3 FESEM images of CuCoTe nanocomposites (a) CuCoTe-6, (b) CuCoTe-7, (c) CuCoTe-8, (d) CuCoTe-9, and (e) CuCoTe-10 at 50 nm (synthesized at 360 W).

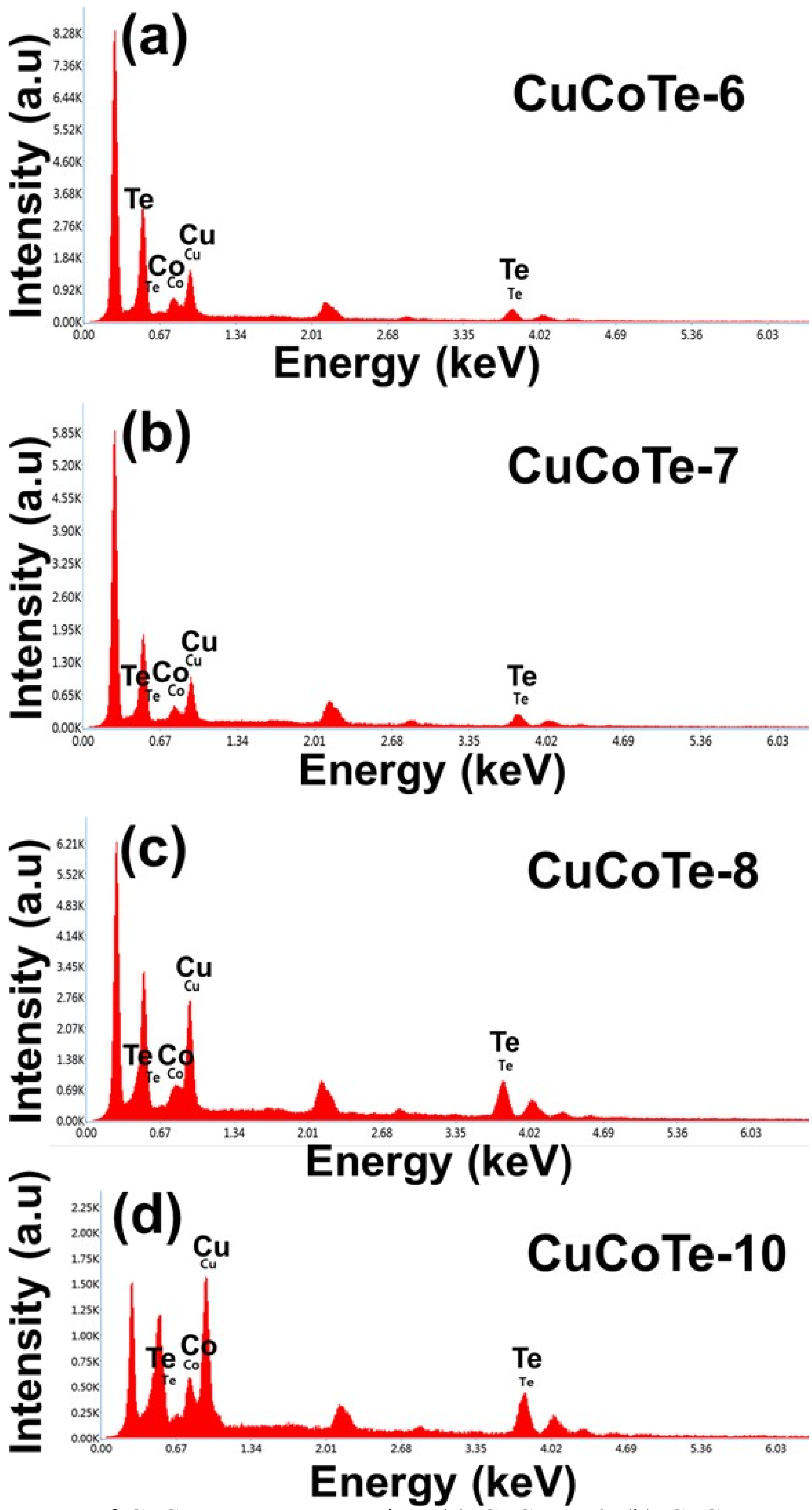

Fig. S4 EDX spectra of CuCoTe nanocomposites (a) CuCoTe-6, (b) CuCoTe-7, (c) CuCoTe-8, and (d) CuCoTe-10 (synthesized at 360 W).

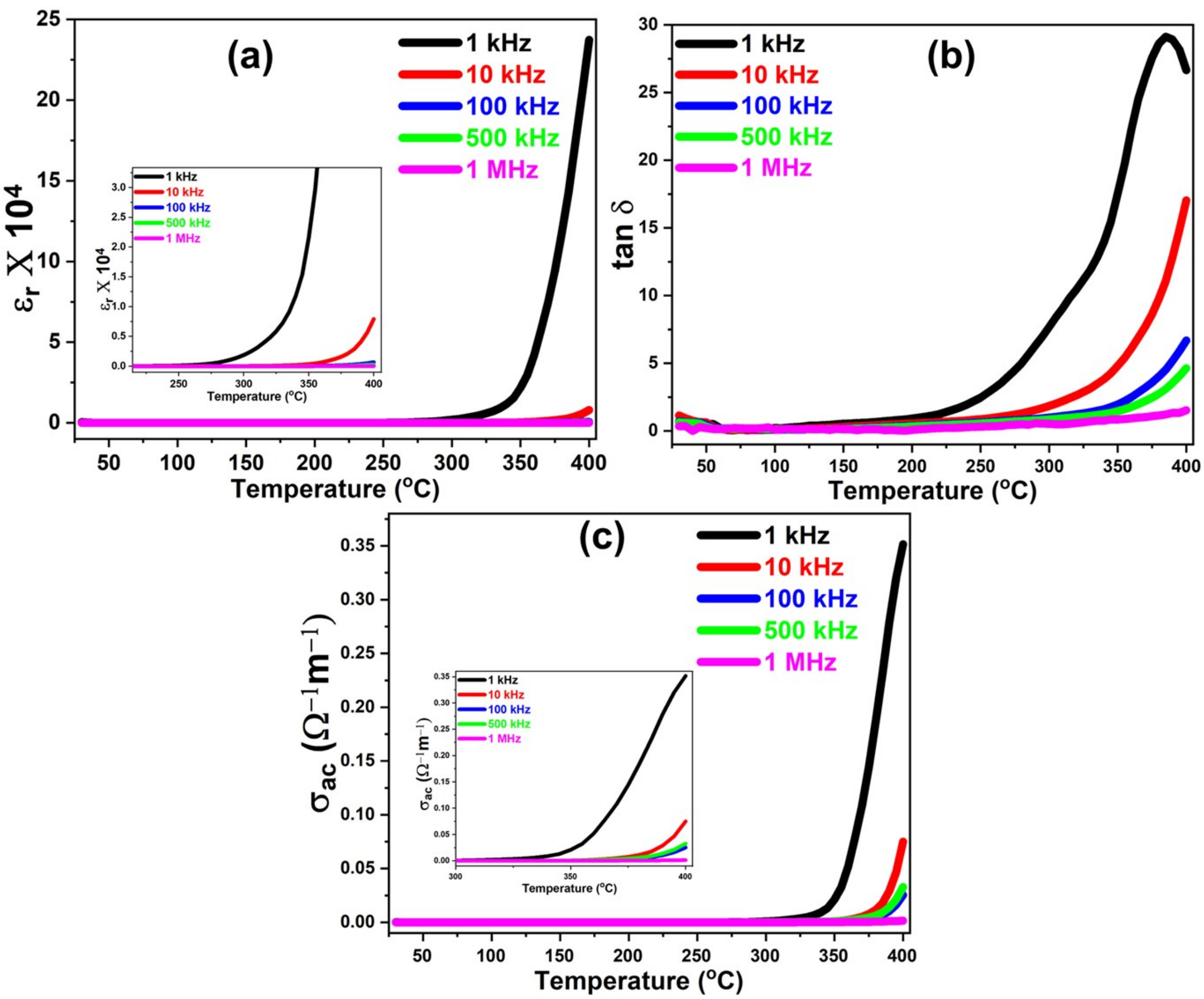

Fig. S5 Variation of (a) ε_r, (b) tan δ, and (c) σ_{ac} of CuCoTe-10 sample with temperature at different frequencies.

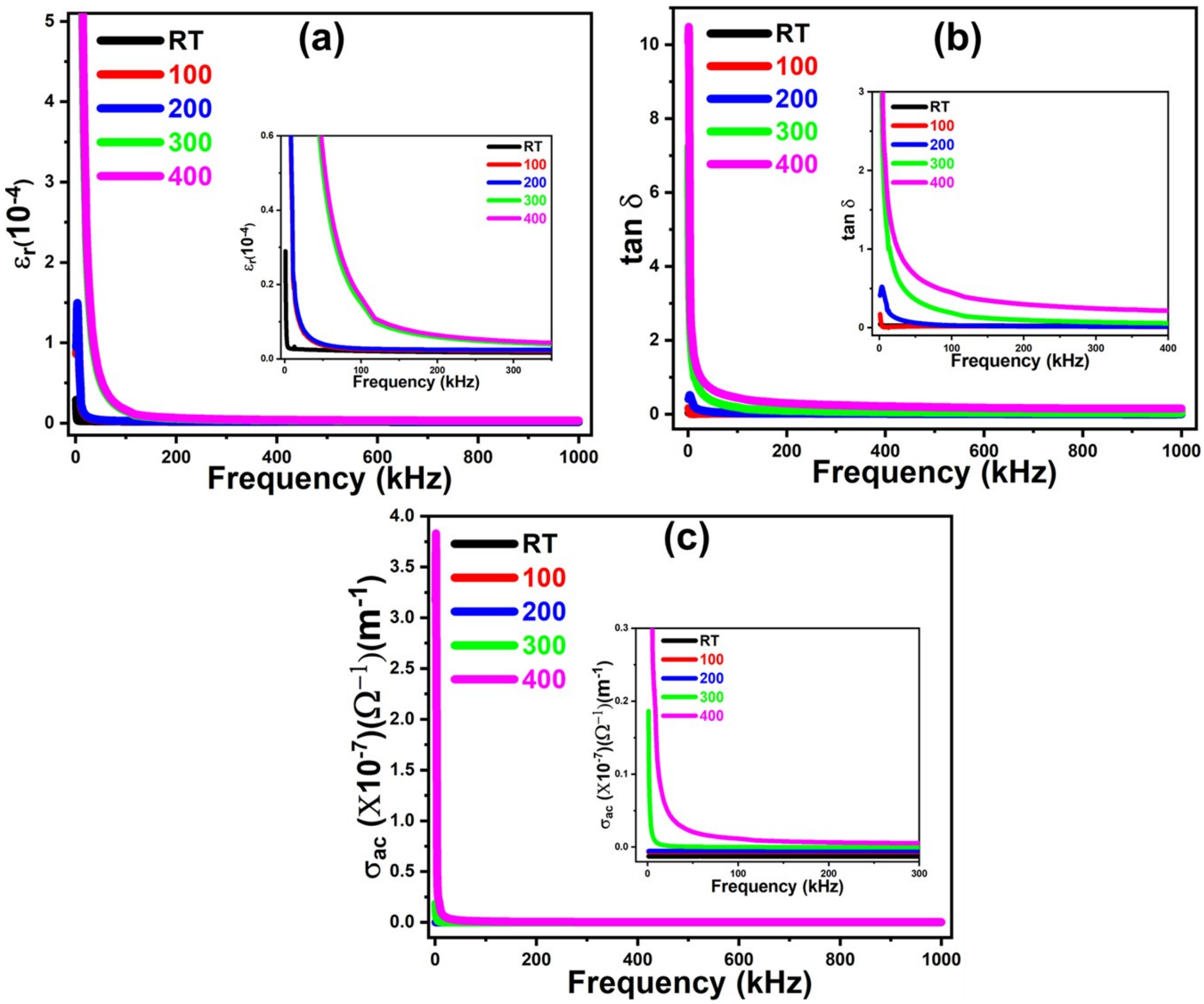

Fig. S6 Variation of (a) ε_r, (b) tan δ, and (c) σ_{ac} of CuCoTe-10 sample with frequency at different temperatures.

Table S1: Comparison of materials for optoelectronic and dielectric applications.

Sl. No.	Material	Applications		Reference
1	Cu_2Te	Optoelectronic	Photodetector: Detectivity: 1.3×10^9 Jones Detection range: 600-1500	1
2	Cu_2Te	Optoelectronic	Direct band gap: 2.04 eV Indirect band gap: 3.05 eV	2
3	$CoTe_2$	Dielectric	Absorption property: 0.2 -2.0 THz	3
4	$CuInZnSe_3$	Dielectric	In the temp. range 60 °C < T < 150 °C, passive carriers inside the material are activated by energy from the outside.	4
5	$Cu_{2-x}Te$	Dielectric	The charge–discharge current density of the battery kept stable at around 90 $mAhg^{-1}$ even after 5000 cycles.	5
6	Bi_2Te_3/G	Dielectric	Li-ion batteries: Charge capacity- 158 mAh g^{-1}	6
7	CdTe	Optoelectronic	Used as absorber layer in CdTe	7
8	PbTe	Optoelectronic	Solar cell: Quantum efficiency: above 120% (external) exceeding 150 % (internal)	8
9	$MoTe_2$-based photodetector	Optoelectronic	Photodetector: Detection range: 0.6-1.55 µm, stable and fast photo response	9

References

[1] B. S. Farag and S. A. Khodier, *Thin Solid Films*, 1991, **205,** 52-57.

[2] P. Kumar and K. Singh, *Cryst. Growth Des.*, 2009, **9,** 3089–3094.

[3] Z. Zhang, Z. Cai, L. Xia, D. Zhao, F. Fan and Y. Huang, *ACS Appl. Mater. Interfaces*, 2021, **13,** 30967−30979.

[4] S. H. Jabarov, S. I. Ibrahimova, F. V. Hajiyeva, E. M. Huseynov, and Y. I. Aliyev, *Arab. J. Sci. Eng.*, 2022, **47,** 7817-7823.

[5] C. Han, Z. Li, W. J. Li, S. L. Chou and S. X. Dou, *J. Mater. Chem. A*, 2014, **2,** 11683–11690.

[6] F. Tu, J. Xie, G. Cao and X. Zhao, *Mater.*, 2012, **5,** 1275–1284.

[7] S. Chander and M. S. Dhaka, *Mater. Sci. Semicond. Process*, 2015, **40,** 70–712.

[8] M. L. Bohm, T. C. Jellicoe, M. Tabachnyk, N. J. Davis, F. Wisnivesky-Rocca-Rivarola, C. Ducati, B. Ehrler, A. A. Bakulin and N. C. Greenham, *Nano Lett.* 2015, **15,** 7987–7993.

[9] H. Huang, J. Wang, W. Hu, L. Liao, P. Wang, X. Wang, F. Gong, Y. Chen, G. Wu and W. Luo, *Nanotechnology*, 2016, **27,** 445201.