PACS: 42.79.Pw, 85.60.Gz, 07.57.Kp, 85.60.Dw

Improvement of SWIR photodetectors intended for space monitoring

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Received 1.03.2023; accepted 14.03.2023

SWIR photodetectors based on heteroepitaxial structures of ternary solution of cadmium mercury telluride (MCT, HgCdTe) and indium gallium arsenide (InGaAs), sensitive in the spectral range from 1 to 2.5 μm, are the most promising for space monitoring. This work presents a review on the recent progress in photosensitive element architectures, and future challenges for SWIR detectors technologies, including materials and forming methods of HgCdTe n-on-p-structures and InGaAs p+-B-n-N+-structures. Current performances of SWIR HgCdTe and InGaAs photodetectors have been investigated in wide temperature range.

Keywords: HgCdTe, InGaSb, FPA, Dark current, Detectivity.

DOI: 10.51368/2307-4469-2023-11-2-128-138

REFERENCES

1. Burlakov I. D., Grinchenko L. Y., Dirochka A. I. and Zaletaev N. B., Usp. Pril. Fiz. (Advances in Applied Physics) **2** (2), 131–162 (2014) [in Russian].

2. Joshi Abhay M., Heine Frank and Feifel Thomas, Proc. of SPIE **6220**, 622003-1-622003-14 (2006), DOI: 10.1117/12.666055

3. Rogalski A., Rep. Prog. Phys. **68**, 2267–2336 (2005).

4. Lei Wen, Antoszewski Jarek and Faraone Lorenzo, Applied Physics Reviews **2**, 041303 (2015).

5. Piotrowski J. and Rogalski A., High-Operating-Temperature Infrared Photodetectors, Bellingham, SPIE Press, 2007.

6. Boltar K. O., Chinareva I. V., Lopuhin A. A. and Iakovleva N. I., Applied Physics, № 5, 10–15 (2013) [in Russian].

7. Boltar K. O., Burlakov I. D., Ponomarenko V. P. and Filachov A. M., Proc. SPIE **7298**, 72982P-1–72982P-15 (2009).

8. TU 1778-293/0-0198396-05.

9. TU 1778-004-03533808-2005.

10. TU 1778–002–05818248–12.

11. William L. A., Planar Double-Layer Heterojunction HgCdTe Photodiodes And Methods For Fabricating Same: Patent US 5.189.297 (1998).

12. Wijewamasuriya P. S., Zandian M., Edwall D. D., McLevige M. V., Chen C. A., Pasko J. G., Hildebrandt H., Chen A. C., Arias J. M., D'Souza A. I., Rujirawat S. and Sivananthan S., J. Electron. Mater., № 27, 54649 (1998).

13. Vuillermet M., Billon-Lanfrey D., Reibel Y., Manissadjian A., Mollard L., Baier N., Gravrand O. and Destéfanis G., Proc. of SPIE **8353**, 83532K (2012).

14. Lutz H., Breiter R., Eich D., Figgemeier H., Fries P., Rutzinger S. and Wendler J., Proc. of SPIE **9819**, 98191Y (2016).

15. Bai Y., Bajaj J., Beletic J. W., Farris M. C., Joshi A., Lauxtermann S., Petersen A. and Williams G., Proc. SPIE **7201**, 702102 (2008).

16. Mynbaev K. D. and Ivanov-Omskii V. I., Physics and technical of semiconductors **40** (1), 3–22 (2006).

17. Mynbaev K. D., Shilyaev A. V., Bazheno N. L., Izhnin A. I., Izhnin I. I., Mikhailov N. N., Varavin V. S. and Dvoretsky S. A., Physics and technical of semiconductors **49** (3), 379–384 (2015).

18. Castelein P., Baier N., Gravrand O., Mollard L., Brellier D., Rochette F., Kerlain A., Rubaldo L., Reibel Y. and Destéfanis G., Proc. of SPIE **9070**, 90702Y (2014).

19. Iakovleva N. I., Boltar K. O., Sednev M. V. and Nikonov A. V., Usp. Prilk. Fiz. (Advances in Applied Physics) **4** (5), 465–470 (2016).

20. Golovin C. V., Burlakov I. D. and Kashuba A. S. Focal Plane Array and methods of fabricating same № 2340981 C1 (RF). 2007.

21. Sednev M. V., Boltar K. O., Sharonov Y. P. and Lopukhin A. A., Applied Physics, № 4, 51–55 (2014) [in Russian].