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# Investigation of optical properties of MWIR CdHgTe nBn heterostructures

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***This paper presents the results of measuring optical reflection and transmission spectra of MWIR CdHgTe nBn heterostructure with an absorbing n-layer, grown by molecular beam (MBE) epitaxy. The thicknesses and compositions of CdHgTe layers have been determined by the fitting parameter method using physical models of incident, reflected and absorbed radiation electric vectors in the multilayer structure. The expected boundary wavelength of the IR photodetector based on this nBn heterostructure have been predicted.***

*Keywords*: infrared detectors, HgCdTe, molecular beam epitaxy, *nBn* structure, transmission spectra.

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**REFERENCES**

1. Voitsekhovskii A. V., Nesmelov S. N., Dzyadukh S. M., Dvoretsky S. A., Mikhailov N. N., Sidorov G. Yu. and Yakushev M. V., Applied Physics, № 1, 25–31 (2020) [in Russian].
2. Olivier Gravrand, Clément Lobre, Jean Louis Santailler, Nicolas Baier, Wilfried Rabaud, Alexandre Kerlain, Diane Sam-Giao, Pascal Leboterf, Benoit Cornus and Laurent Rubaldo, Proc. SPIE. Infrared Technology and Applications XLVIII **12107**, 121070U (2022).
3. Antoni Rogalski, Piotr Martyniuk, Malgorzata Kopytko, Pawel Madejczyk and Sanjay Krishna, Sensors, № 20, 7047 (2020).
4. Evirgen A., Abautret J., Perez J. P., et al., Electron. Lett. **50**, 1472–73 (2014).
5. Soibel A., Ting D. Z., Rafol S. B., et al., Appl. Phys. Lett. **114**, 161103 (2019).
6. Akhavan N. D., Umana-Membreno G. A., Gu R., et al., IEEE Trans. Electron Dev. **63** (12), 4811–4818 (2016).
7. Kopytko M., Wróbel J., Jóźwikowski K., et al., J. Electron. Mater. **44** (1), 158–166 (2015).
8. Martyniuk P., Kopytko M. and Rogalski A., Opto-Electron. Rev. **22** (2), 127–146 (2014).
9. Voitsekhovskii A. V., Nesmelov S. N., Dzyadukh S. M., et al., Mater. Res. Expr. **6** (11), 116411 (2019).
10. Voitsekhovskii A. V., Nesmelov S. N., Dzyadukh S. M., et al., Izv. vuzov. Physics **62** (5), 77–85 (2019).
11. Belogorokhov A. I., Belogorokhova L. I., Denisov I. A., Smirnova N. A., Kobeleva S. P. and Florentsev A. A., Materials of electronic technique, № 2, 43–49 (2003).
12. Pavlov L. P., Measuring methods of semiconductor materials, Moscow, Higher School, 1987, pp. 222–225.
13. Boltar K. O. and Fedirko V. A. Abstracts of the V Industry Conference. Analytical research methods of materials and microelectronics products. Moscow, Central Research Institute «Electronics», 1989, pp. 169–170.
14. Boltar K. O., Yakovleva N. I., Kashuba A. S. and Udalova A. G., Applied Physics, № 1, 26–31 (2008) [in Russian].
15. Hansen G. L., Schmit J. L. and Casselman T. N., J. Appl. Phys. **53**, 7099–7101 (1982).
16. Melnikov A. A., Proceedings of SPIE **325**, 4340 (2000).
17. Nikonov A. V., Boltar K. O. and Yakovleva N. I., Applied Physics, № 5, 100–106 (2011) [in Russian].
18. Born M. and Wolf E., Fundamentals of optics. Translated from English, ed. Motulevich G. P., Moscow, Nauka, 1970, pp. 77–96.
19. Boltar K. O. and Yakovleva N. I., Proceedings of SPIE **6636** (1), 663606-1–663606-7 (2007).
20. Lubzens D., Rosenfeld D. and Nemirovsky Y., Infrared Phys. **28** (6), 417–423 (1988).
21. Laurenti J. P., Camassel J., Bouhemadou A., Toulouse B., Legros R. and Lusson A., J. Appl. Phys. **67** (10), 6454 (1990).
22. Finkman E. and Nemirovsky Y., J. Appl. Phys. **50** (6), 4356–4361 (1979).
23. Varavin V. S., Vasiliev V. V., Dvoretsky S. A., Mikhailov N. N., Ovsyuk V. N., Sidorov Yu. G., Suslyakov A. O., Yakushev M. V. and Aseev A. L., Optoelectronics Rewier, № 11 (2), 99–111 (2003).
24. Voitsekhovsky A. V., Nesmelov S. N., Dzyadukh S. M., Dvoretsky S. A., Mikhailov N. N., Sidorov G. Yu. and Yakushev M. V., Letters in J. Physics and Technics of Semiconductors **47** (12), 34–37 (2021).