

Investigation of the spectral response of *n*Bn photodiodes based on InAsSb

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*The classical structure of *n*Bn photodiode based on InAsSb for the detection in the middle wavelength infrared (MWIR) has been considered. The optical absorption in the heterostructure at any position has been calculated taking into account the absorption features of the InAsSb active layer, such as the Burstein-Moss effect and the Urbach rule. The quantum efficiency and spectral response of the sensitivity have been calculated taking into account multiple reflections at the interfaces of the heterostructure and the features of free carrier absorption in the GaSb substrate. The optimal thickness of the *n*Bn photodiode active layer has been determined for the various values of minority carrier lifetime. The achievement of high values of the BLIP detectivity of the FPA has been shown.*

Keywords: InAsSb, *n*Bn photodiode, quantum efficiency, spectral sensitivity, IR photodetector.

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REFERENCES

- Reibel Y., Taalat R., Brunner A., Rubaldo L., Augey T., Kerlain A., Péré-Laperne N., Manissadjian A., Gravrand O., Castelein P. and Destéfánis G., *Infrared Technology and Applications XLI*. SPIE **9451**, 256 (2015).
- Wu D., Li J., Dehzangi A. and Razeghi M., *Infrared Physics & Technology* **109**, 103439 (2020).
- Martyniuk P. and Rogalski A., *Opto-Electronics Review* **21** (2), 239 (2013).
- Gershon G., Avnon E., Brumer M., Freiman W., Karni Y., Niderman T., Ofer O., Rosenstock T., Seref D., Shiloah N., Shkedy L., Tessler R. and Shtrichman I., *Infrared Technology and Applications XLIII*. SPIE **10177**, 334 (2017).
- Shkedy L., Armon E., Avnon E., Ben Ari N., Brumer M., Jakobson C., Klipstein P. C., Lury Y., Magen O., Milgrom B., Rosenstock T., Shiloah N. and Shtrichman I., *Infrared Technology and Applications XLVII*. SPIE **11741**, 146 (2021).
- Vurgaftman I., Meyer J. R. and Ram-Mohan L. R., *Journal of Applied Physics* **89** (11), 5815 (2001).
- Martyniuk P. and Gawron W., *Metrology and Measurement Systems* **21** (4), 675 (2014).
- Kovshov V. S., Yakovleva N. I. and Nikonov A. V., *Usp. Prikl. Fiz.* **10** (3), 277 (2022) [in Russian].
- Anderson W. W., *Infrared Physics* **20** (6), 363 (1980).
- Rogalski A., Martyniuk P., Kopytko M., Madejczyk P. and Krishna S., *Sensors* **20** (24), 7047 (2020).
- Shalimova K. V., *Fizika poluprovodnikov: uchebnoe posobie*. Moscow, Energiya, 1976.
- Bhowmick M., Xi H. and Ullrich B., *Materials* **14** (7), 1639 (2021).
- Born M. and Wolf E., *Osnovy optiki*. edited by Motulevich G. P. Moscow, Nauka, 1970.
- Deng X. H., Liu J. T., Yuan J. R., Liao Q. H., and Liu N. H., *Europhysics Letters* **109** (2), 27002 (2015).
- Deparis O., *Optics letters* **36** (20), 3960 (2011).
- Dutta P. S., Bhat H. L. and Kumar V., *Journal of Applied Physics* **81** (9), 5821 (1997).
- Chandola A., Pino R. and Dutta P. S., *Semiconductor Science and Technology* **20** (8), 886 (2005).
- Roodenko K., Liao P.-K., Lan D., Clark K. P., Fraser E. D., Vargason K. W., Kuo J.-M., Kao Y.-C. and Pinsukanjana P. R., *Image Sensing Technologies: Materials, Devices, Systems, and Applications III*. SPIE **9854**, 187 (2016).
- Roodenko K., Liao P.-K., Lan D., Clark K. P., Fraser E. D., Vargason K. W., Kuo J.-M., Kao Y.-C. and Pinsukanjana P. R., *Journal of Applied Physics* **119** (13), 135701 (2016).
- Rogalski A., *Infrared and terahertz detectors*, CRC press, USA, 2019.