

## Capacitance-voltage characteristics based on indium antimonide MIS-structures study

V. P. Astakhov<sup>1</sup>, K. S. Andreichikov<sup>1,2</sup>, I. A. Dubenskaya<sup>1,2</sup> and E. V. Molodcova<sup>3</sup>

<sup>1</sup> Moskovsky zavod «SAPFIR». J.S.C.  
Bld. 4A, 3A, Dneprohetrovskiy passage, Moscow, 117545, Russia  
E-mail: andreichikoff.kirill@yandex.ru

<sup>2</sup> NUST MISIS  
Bd. 4, 1, Leninsky Prospekt, Moscow, 119049, Russia

<sup>3</sup> "Giredmet". J.S.C.  
Bd. 2, Electrodnaya st., Moscow, 111524, Russia

Received 9.02.2023; revised 20.03.2023; accepted 28.03.2023

*The work is devoted to study of capacitance-voltage (CV) characteristics metal-insulator-semiconductor (MIS) structures, fabricated from single-crystal indium antimonide plates cut along the (211) and (100) planes from an ingot grown in the [211] direction and along the plane (100) from an ingot grown in the [100] direction. MIS structures were of two types: with an anode oxide layer and with a protective dielectric composition, including additional layer of SiO<sub>x</sub>. Measurements of the CV curve of MIS structures flooded with liquid nitrogen were carried out with multiple forward (starting from zero bias at the field electrode) and reverse "passes" at a bias voltage change rate 500 mV/s. Analysis results of "passes" made it possible to determine the sign and values of the effective surface charge in the initial state and after each direct "pass" when additional charges of two types are detected: stable and unstable. The sign of these charges is opposite to the polarity of the voltage on the field electrode. Stable charges are unchanged during the entire cooling time and "drain" only when the MIS structure is "warmed up". Unstable ones "drain" already when the cooled MIS structure is short-circuited.*

*It is shown that the values of all types of surface charge, and hence the concentration of traps, are minimal in the case of plates cut along the (100) plane from ingots grown in the [100] direc*

**Keywords:** capacitance-voltage characteristic, MIS-structure, indium antimonide, effective surface charge.

DOI: 10.51368/2307-4469-2023-11-2-146-154

### REFERENCES

1. Etchells A. and Fisher C. W., J. Appl. Phys. **47** (10), 4605–4610 (1976).
2. Kozharinova E. A., Batyrev N. I., Kostyshina L. A. and Umnikova E. V., Usp. Prikl. Fiz. **5** (2), 174–178 (2017) [in Russian].
3. Astakhov V. P., Gindin P. D., Karpov V. V. and Talimov A. V., Applied Physics, № 1, 56–62 (2002) [in Russian].
4. Mirofyanchenko A. E., Mirofyanchenko E. V., La-rentyev N. A. and Popov V. S., Applied Physics, № 3, 33–37 (2020) [in Russian].
5. Iryulin P. V., Turinov V. I. and Yakimov E. B., Semiconductors **38** (4), 480–485 (2004).
6. Astakhov V. P., Karpov V. V., Karpukhin V. V. and Chishko V. F., Applied Physics, № 4, 79–82 (2012) [in Russian].
7. Whelan M. V., Philips Res. Repts. **20**, 620–632 (1965).