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1. *Zaitseva N. and Carman L.* Rapid growth of KDP-type crystal // Progress in Crystal Growth and Characterization of Materials. 2001. V. 43. No. 1. P. 1–118.
2. *Andreev N., Babin A., Bredikhin V., and Ershov V.* Production of large-size optics from water-soluble crystals // Photonics. 2007. No. 5. P. 34–37.

F-20

SECOND HARMONIC GENERATION IN POLYCRYSTALLINE ZnSe IN THE ABSENCE OF PHASE MATCHING

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In this work, we investigated the processes of second harmonic generation (SHG) in the near-IR region on polycrystalline zinc selenide (ZnSe). A YAP:Tm^{3+} Q-switched laser operating at a wavelength of 1940 nm was used as the source of the fundamental wave. The polished samples were manufactured of high quality CVD-ZnSe and were produced in the form of rectangular parallelepipeds of various lengths. Some of the samples were subjected to additional high isostatic pressure treatment (HIP) in order to increase the average crystal grain size.

Experimental studies of the dependence of the SHG conversion efficiency on the average grain size in ZnSe polycrystals, on the sample lengths and also on the crystallite growth direction in the bulk material have been carried out. In addition, a numerical simulation of the SHG process in the absence of phase matching in polycrystalline ZnSe was performed taking into account the size distribution of particles (crystallites). As a result of the work, it was found that the average crystal grain size has a decisive importance for nonlinear optical converting in this material, while the crystallite growth direction does not significantly affect the SHG efficiency. The results obtained in this work can be useful in the development of laser systems based on polycrystalline zinc selenide.

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F-21

UNIPOLAR BARRIER STRUCTURES BASED ON HgCdTe FOR INFRARED DETECTION

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One of the topical areas of solid state photoelectronics is the creation of infrared detectors based on unipolar barrier systems (for example, with an *nBn* architecture). The greatest progress has been achieved in the development of barrier detectors based on semiconductors of the $A^{III}B^{V}$ group, which is associated with the possibility of realizing systems with a zero barrier in the valence band. Unipolar barrier detectors based on mercury cadmium telluride (HgCdTe) grown by molecular beam epitaxy (MBE) are of interest due to significant technological advantages, since the creation of such devices can abandon the defect forming procedure of ion implantation. Despite a significant number of theoretical works, only a few attempts are known to practically implement *nBn* detectors based on MBE HgCdTe.

The report presents the first results of electrical characterization of *nBn* structures based on MBE HgCdTe grown at the Institute of Semiconductor Physics SB RAS on GaAs substrates (013). The layer parameters in *nBn* systems made it possible to provide detection in the spectral regions of the transparency windows of the Earth's atmosphere of 3–5 (MWIR) and 8–12 (LWIR) μm. We fabricated MWIR and LWIR *nBn* structures with different diameters (from 20 to 500 μm), which made it possible to study the role of various current components (volumetric and surface leakage). The side walls of the walls of the mesa structures were passivated with Al_2O_3 films formed by plasma atomic layer deposition at a temperature of 120 °C; for comparison, structures were fabricated without passivation.

Studies of MWIR *nBn* structures with a composition of 0.84 in the barrier layer showed that dark currents in such structures in a wide temperature range (180–300 K) are limited by hole diffusion from the absorbing layer. At a lower composition in the barrier layer (0.64–0.67) of MWIR *nBn* structures, the role of the surface leakage component increases. The dark current in LWIR *nBn* structures at a temperature of 300 K and a bias of –2 V is 0.241–0.247 A/cm when the side walls are passivated with an Al_2O_3 film. In LWIR *nBn* structures without sidewall passivation, the role of surface leakage increases, the density of which is in the range of 0.423–0.432 A/cm. Dark currents in MWIR *nBn* structures are in good agreement with the empirical Rule07 model, which indicates the possibility of creating efficient unipolar barrier detectors based on MBE HgCdTe. For LWIR *nBn* structures, dark currents at small reverse biases are limited by the bulk component, and the activation energy of this current is in good agreement with the band gap of the absorbing layer. Studying the admittance of test MIS devices based on *nBn* structures in a wide range of temperatures showed that with high-quality passivation of the side walls of mesa structures, it is possible to create efficient LWIR *nBn* detectors based on MBE HgCdTe.

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THRESHOLD OF LASER DESTRUCTION OF NONLINEAR GaSe AND GaSe:In CRYSTALS WHEN EXPOSED TO PULSED RADIATION AT A WAVELENGTH OF 2.1 MICRONS

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The aim of this work is to determine the optical breakdown threshold of a single crystal GaSe and GaSe:In when exposed to nanosecond radiation of the two micron range and determining the influence of the energy parameters of the testing radiation on the breakdown threshold. The Ho^{3+}:YAG laser was used as the laser radiation source in this work. Pumping was carried out by a Thule fiber laser. Two GaSe and GaSe:In crystals were used as the studied samples. According to the results of the holographic experiment, no inclusions and volume defects were found in the GaSe sample, except for microcracks. In GaSe:In samples, volume inclusions with a size of ~ 300 microns were detected. The optical breakdown threshold is determined by the energy density and power density of the GaSe crystal and the GaSe crystal: In when the parameters of the test radiation are close to the parameters of the pump radiation of promising dual frequency OPO (which are effective sources of pumping THz generators of difference frequency): the wavelength is 2.091 microns, the pulse repetition frequency is 12 and 20 kHz, the pulse duration is 18–22 ns. In a sample doped with In, with an increase in the pulse repetition frequency, a more significant decrease in the optical breakdown threshold is observed than in a non-doped sample. These results indicate a significant influence of the bulk defects found in the GaSe:In sample indicates accumulation effects that increase with increasing frequency, which leads to a drop in the breakdown threshold with increasing pulse repetition frequency.