AMPL-2021

PULSED LASERS AND LASER APPLICATIONS

September 12–17, 2021
Tomsk, Russia

ABSTRACTS

GENERAL SPONSOR
Special Systems. Photonics, St. Petersburg, Russia

CONFERENCE ORGANIZERS
Institute of Atmospheric Optics SB RAS
Institute of High Current Electronics SB RAS
Tomsk State University
Tomsk Polytechnic University

CONFERENCE SPONSORS
Ministry of Education and Science of Russian Federation, Russia
Russian Academy of Sciences, Russia
Siberian Branch of Russian Academy of Science, Russia
Laser Association, Russia

CONFERENCE SPONSORS
TOPAZ Research and Inculcation Enterprise, Tomsk, Russia
Young Scientists Council IAO SB RAS, Tomsk, Russia
SP Equipment, Novosibirsk, Russia
Azimut Photonics, Moscow, Russia
LOTIS TII, Minsk, Belarus
Special Systems. Photonics, St.-Petersburg, Russia
CLZ Ltd, Moscow, Russia
Leningrad Laser Systems, St.-Petersburg, Russia

MEDIA SPONSORS
Atmospheric and Oceanic Optics Journal, Tomsk, Russia
Photonics Journal, Moscow, Russia

Tomsk, 2021
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 Al2O3 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 Al2O3 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.

The research was carried out with the financial support of the Russian Science Foundation within the framework of the Project No. 19-12-00135.

F-22

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

N.N. Yudin1,2,3, O.L. Antipov4, V.V. Demin2, A.I. Gribenyukov5, M.M. Zinoviev1,2,3, S.N. Podzivalov2,3, E.A. Slyunko2,3, E.V. Zhuravlev1, and A.A. Pfeif2

1Institute of Atmospheric Optics SB RAS, 1 Zuev Sq., 634055 Tomsk, Russia, muxa9229@gmail.com;
2Tomsk State University, 36 Lenin Ave., 634050, Tomsk, Russia, rach3@yandex.ru;
3LLC ”Laboratory of Optical Crystals”, 7, 28 Vysotsky St., 634040 Tomsk, Russia, cginen@yandex.ru;
4Institute of Applied Physics RAS, 46 Ul’yanov St., 603950, Nizhny Novgorod, Russia, antipov@ipfran.ru;
5Institute of Monitoring of Climatic and Ecological Systems SB RAS, 10/3 Akademichesky Ave., 634021, Tomsk, Russia, alexander.gribenyukov@yandex.ru

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 Ho3+: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:In 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.