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 Counsil 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

Scientific & Technical Translations
STT
PUBLISHING
Tomsk, 2021

Y-24

FORMATION OF THE SCATTERING PHASE FUNCTION IN THE INTERACTION OF ULTRASHORT LASER PULSES WITH A DROP IN A NONLINEAR MODE

P.A. Babushkin, A.D. Bulygin, E.A. Danilkin, O.I. Kuchinskaya, O.V. Minina, and A.V. Petrov

Institute of Atmospheric Optics SB RAS, 1 Zuev Sq., 634055 Tomsk, Russia,bpa@iao.ru, b.a.d@iao.ru, danilkine@gmail.com, olesyatsu14@mail.ru, mov@iao.ru, awp@iao.ru;

The propagation of ultrashort laser pulses in the atmosphere is accompanied by nonlinear effects. The most low-threshold of them is the effect of cubic nonlinearity along with nonlinear absorption manifesting in aerosol. This effect should lead to the transformation of the scattering phase function formed in a liquid droplet aerosol. To study this effect, numerical and experimental studies on droplets of various sizes and geometries were carried out. As expected, the cubic nonlinearity inclusion should lead to an increase in the effect of backward scattering.

The reported study was funded by RFBR and Tomsk region according to the research Project No. 19-42-703015.

Y-25

PROSPECTS OF CONTROLLING THE PROPAGATION OF HIGH POWER THZ RADIATION BY PASSIVE OPTICAL ELEMENTS INCLUDING 3D PRINTED

D.M. Ezhov[1], D.M. Lubenko[2], V.F. Losev[2], and Yu.M. Andreev[3]

[1]Tomsk State University, 36 Lenin Ave., 634050, Tomsk, Russia, ezhov_dm@mail.ru;
[2]Institute of High Current Electronics SB RAS, 2/3 Akademichesky Ave., 634055, Tomsk, Russia, lubenkodm@gmail.com;
[3]Institute of Monitoring of Climatic and Ecological Systems SB RAS, 10/3 Akademichesky Ave., 634055, Tomsk, Russia, yuandreev@yandex.ru

Different types of optical elements for controlling high power THz radiation were studied. Controlling was performed utilizing amplitude modulation of the electric field and effective spatial modulation of the complex dielectric susceptibility in the volume of the THz filter. We make a comparison of attenuation efficiency of various options of 3D printed filters when ABS filament is mixed with perovskite microparticles. Another type of filter was obtained by the deposition of magnetic particles in the presence of an external magnetic field in a transparent polymer matrix. Industrial isotropic cut-off filters based on layered meta structures have also been investigated. A comparison is made of the efficiency of attenuation of linearly polarized THz radiation with homemade band-pass polarizers obtained by etching copper from a flexible polyimide substrate and industrial filters. Filters and polarizers created using 3D printing, or by deposition of polymer matrix with magnetic particles under external field, are attractive cost effective elements.

This study was supported by Russian Science Foundation (RSF), Project No. 19-19-00241.

Y-26

DEVELOPMENT OF SERS SUBSTRATES BASED ON NANOPARTICLES OBTAINED BY PULSED LASER ABLATION

A.V. Volokitina, I.N. Lapin and V.A. Svetlichnyi

Tomsk State University, 36 Lenin Ave., 634050, Tomsk, Russia, nvv0404@gmail.com

SERS spectroscopy is an effective method for the determination of organic and biological compounds, which finds its place in many areas of human life: the analysis of works of art and food

products, the identification of drugs and drugs, the study of biological structures, incl. at the cellular level. The creation of simple and effective SERS substrates is an urgent task in the development of this method.

This paper presents the results of a study of SERS substrates based on gold nanoparticles (NPs). Gold NPs were obtained by pulsed laser ablation of an Au metal target in alcohol using a Nd:YAG laser (1064 nm, 7 ns, 150 mJ). The resulting colloidal solution was applied onto glass substrates by the drop method, varying the number of layers. The SERS characteristics were studied using a model dye rhodamine 6G using Renishaw inVia Basis Raman microscope. The samples were excited in the region of surface plasmon resonance of gold by laser radiation of 532 nm. The results of the study showed that with an increase in the number of deposited layers up to 5, the intensity of the Raman scattering of the dye increases linearly. With a further increase in the number of layers, the signal saturates. This data correlates with SEM data. At the beginning, an increase in the packing density of NPs in the plane of the substrate is observed. Accordingly, the number of "hot spots" increases, which contribute to the amplification of the signal. Further, the homogeneity of the NP layer deteriorates, and large bulk agglomerates appear. Thus, we have developed a simple method for obtaining SERS substrates, which made it possible to increase the signal intensity up to three orders of magnitude.

Y-27

PHOTO AND ELECTROLUMINESCENCE OF 2-CIANO-3-ARYL-DERIVATIVES OF PYRAZINE

L.G. Samsonova, K.M. Degtyarenko, R.M. Gadirov, E.V. Sapozhnikova

Tomsk State University, 36 Lenin Ave., 634050, Tomsk, Russia, esapozhnikova9@gmail.com

At present time area of creating organic light emitting diodes (OLED) is actively developing. Nowadays it is necessary to find new organic compounds that can be used as a light emitting layer in blue diodes. This work is devoted to making organic light emitting diodes that emit in the blue area of spectrum.

In this work six organic compounds were studied. First three compounds had pyrazine as an electron acceptor group. Triphenylamine and carbazole fragments were used as an electron donor groups. Three other compounds had pyrazine with added cyano group. Spectral characteristics of these organic compounds in polar and nonpolar solvents and vapor deposited organic films were investigated.

OLED cells based on organic compounds were fabricated using method of vapor deposition. For organic compound with cyano group OLED cells with doped light emitting layer were also made. Spectra of electroluminescence, volt ampere and volt luminance characteristics of created diodes were also measured.

Organic compounds that were used in this work showed promising results for practical application as a light emitting layer in blue OLED.

Y-28

APPLICATION OF WATER SOLUBLE LUMINESCENT EUROPIUM COMPLEXES AS TEMPERATURE SENSORS: PROSPECTS AND PROBLEMS

D.A. Kharitonov, A.V. Kharcheva, O.K. Farat, N.E. Borisova, and S.V. Patsaeva

Moscow State University, GSP-1, Leninskie Gory, 119991, Moscow, Russia, kh_dimaa@mail.ru

Europium complexes with organic ligands are important in luminescence measurements: they are well suited for creating chemical, pH, and temperature probes. For biological and medical fields, the ligand must perform effective sensitization of the europium ion, the complex must be water soluble, non-toxic, stable in the desired temperature range. For successful temperature measurements, the europium complex must have more specific properties as thermal stability and reproducibility of the