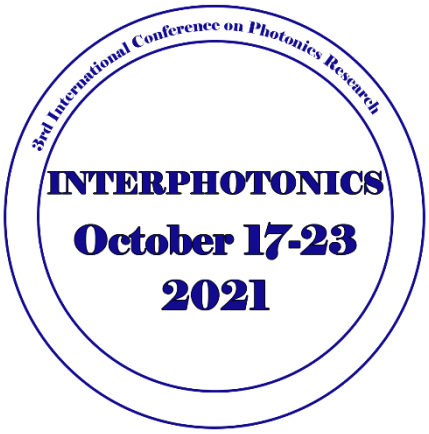
Book of Abstracts

INTERPHOTONICS 2021



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(INTERPHOTONICS 2021)

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Anton Bourdine	JSC, Russian Federation
Dana Seyringer	Vorarlberg University of Applied Sciences, Research Centre for Microtechnology, Austria
Dina Deyneko	Lomonosov Moscow State University, Russian Federation
Humeyra Orucu	Ege Üniversitesi, Turkey
Ivana Panžić	University of Zagreb, Croatia
Janis Spigulis	University of Latvia, Latvia
Jozef Chovan	Slovak Centre of Scientific and Technical Information, International Laser Centre, Slovakia
Kirill Larin	University of Houston, USA
Sergey Klimonsky	Lomonosov Moscow State University, Russian Federation
Vesna Janicki	Ruder Boskovic Institute, Croatia
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INVITED SPEAKERS

Id-475

Emerging Methods of Optical Elastography for Ocular Biomechanics

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Abstract: Several optical methods are emerging as powerful tools for noninvasive quantification of viscoelastic properties of ocular tissues such as cornea, lens, sclera, and the retina. In this presentation, I'll overview recent progress made on development and application of Optical Coherence Elastography (OCE) and Brillouin Spectroscopy techniques for quantification of mechanical properties of ocular tissues in normal and pathological states.
Keywords: Biomechanics, OCT, Brillouin.

INVITED SPEAKERS

Id-504

Excitonic Terahertz Luminescence from Semiconductors

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Abstract: The terahertz (THz) radiation due to optical transitions between the energy levels of free excitons in semiconductors was experimentally discovered and investigated. The intraexciton THz radiative transitions occur during energy relaxation upon binding of nonequilibrium charge carriers into free excitons. The main experiments were performed on crystals of high-purity silicon with interband optical excitation. At a sufficiently high level of interband photoexcitation, the appearance of stimulated intraexciton THz radiation was detected. Over the past two decades, intensive research has been conducted in the field of creating sources of electromagnetic radiation in the terahertz range (with frequencies from 0.1 to 15 THz). One of the possible schemes for a relatively simple, fast electronic THz emitter is based on optical transitions between the levels of shallow impurities in semiconductors. The intracenter THz radiative transitions occur during the energy relaxation of nonequilibrium charge carriers created in an allowed band, for example, as a result of photoionization of impurities by the radiation of a CO_2-laser or during impact ionization of impurities in high electric fields. At intracenter optical transitions in Ge and Si, THz laser generation has been achieved. It should be noted that the processes of energy relaxation during the capture of nonequilibrium carriers by attracting shallow impurity centers and upon binding of nonequilibrium electrons and holes into free excitons have much in common. Therefore, it is natural to expect that when free carriers are captured into excitons, THz optical transitions between levels of the free exciton states also occur, similarly to intracenter optical transitions in shallow impurity centers. Nevertheless, up to the present time, intarexciton THz radiation has not been experimentally studied. The authors of this work have the priority of the first experimental observation of THz radiation due to optical transitions between the energy levels of free excitons in semiconductors. The first experiments were carried out on silicon crystals under conditions of interband photoexcitation. An important property of intraexciton THz radiation is that, unlike intracenter (due to optical transitions in shallow impurity centers) one, it does not tend to saturate at high excitation levels and, therefore, intraexciton THz radiation can reach high intensity under intense pumping. It is important to note, that in a number of theoretical studies, the possibility of creating a population inversion

between the energy levels of free excitons due to several mechanisms and, correspondingly, THz laser radiation with intense interband photoexcitation of a crystal has been predicted. However, there were no direct experimental data confirming this possibility. In the recent experiments of the authors of this work, the appearance of stimulated THz radiation in a system of excitons in silicon crystals was first discovered, with rather moderate thresholds in pump intensity: of about 7 W/cm^2. The observed THz amplification coefficients indicate that a new type of THz laser can be created at transitions between exciton energy levels.

This work was partly supported by RFBR (Project #18-02-00002).

Keywords: Terahertz Radiation, Optical Transitions, Excitons.

INVITED SPEAKERS

Id-513

Influence of Al Doping on Morphology and Electrical Properties of ZnO Nanorods

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Abstract: Pure and Al doped ZnO nanorods were prepared by a two-step chemical bath synthesis. The synthesis reposes on the deposition of a seed layer, i.e. spin coating of a thin-film of Zn solution on a silicon wafer in the first step, and on growing of the zincite nanorods (ZNRs), i.e. immersion of seed layer in an equimolar zinc nitrate and hexamethylenetetramine solution at elevated temperature for 1 h in the second step. For Al doped ZNRs the stoichiometry was adjusted by 3 at% of aluminium nitrate nonahydrate. The properties of the derived ZNRs and Al-doped-ZNRs thin-films were characterized by X-ray Diffraction (XRD), atomic force microscopy (AFM) and field emission gun scanning electron microscopy (FEG SEM) with energy dispersive X-ray spectroscopy (EDS). Structurally, the diffraction results point out to compositional differences of the nanorods as a result of the Al doping. Morphologic microscopy results are in concordance with diffraction data and additionally point out to a change in the geometry of the nanorods as a result of the Al doping. Electrical properties were examined by Kelvin probe force microscopy (KPFM) and by temperature-dependent current-voltage (I-V) measurements on Au/(Al)ZnO NR/n-Si junctions. The doping lead to an increase of conductivity of the ZnO NRs by an order of magnitude. The I-V characteristics for the pure and doped NRs follow the ohmic regime at lower voltages, while for the higher voltages the observed changes were attributed to the successful Al doping. The increase in the conductivity and shifting of the geometry of the nanorods can influence the overall electric transport properties which is a desirable behaviour in the area of photocatalysis and photovoltaics.

This work has been supported by the projects PZS-2019-02-1555 in Research Cooperability Programme funded by the European Union from the European Social Fund under the Operational Programme Efficient Human Resources 2014-2020 and UIP-2019-04-2367 of the Croatian Science Foundation.

Keywords: ZnO nanorods, N-Type Doping, Chemical Bath Synthesis, Electrical Transport Mechanism, KPFM

INVITED SPEAKERS

Id-524

New 100-µm-Core Silica Laser-Optimized Multimode Optical Fibers for Gigabit Data Transmission Over On-Board and Industrial Networks

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Abstract: We present designed and fabricated new class of silica graded index laser-optimized multimode optical fibers (LOMF) with extremely enlarged core diameter up to 100 µm and "typical" "telecommunication" cladding diameter 125 µm. This optical fiber is targeted for harsh environment short-range multi-Gigabit onboard cable systems and industrial networks. Proposed LOMF 100/125 differs by specially optimized graded refractive index profile, that provides low differential mode delay (DMD) for selected guided modes, occurred by laser source excitation with following mode power mixing due to optical fiber irregularities and micro-/macro-bends. Here we utilized earlier on developed method for DMD management of selected guided modes with particular orders under following customization for 100 µm core LOMFs. As a result, a set of LOMF 100/125 optimized refractive index profiles was computed, that provides theory DMD value less 300 ps/km and predicted the worst case effective modal bandwidth at least 2500 MHz-km over “O”-band. During the next step, we selected “the simplest” form of computed refractive index profiles, then optical fiber preform was manufactured with outer diameter 28.730 mm and "core" diameter 23.138 mm, which "cladding" is pure silica, while desired graded refractive index profile in "core" region was formed by Ge/F dopants. Finally we drew pilot 520 m length of designed LOMF 100/125. We present results of test sets, performed for fabricated

pilot 520 m length of described LOMF 100/125, concerned with its geometry properties together with transmission parameters (attenuation and DMD map), as well as both 1000Base-LX/SX and 10GBase-LX/SX channel BER measurements.

This research was funded by RFBR, DST, NSFC and NRF according to the research project 19-57-800016 BRICS_t.

Keywords: Laser-Based Gigabit Data Transmission, Laser-Optimized Large Core Multimode Optical Fibers, Short-Range Optical Networks, Differential Mode Delay, Graded Refractive Index Profile Optimization.

INVITED SPEAKERS

Id-526

Arrayed Waveguide Gratings for Photonics Applications

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Abstract: Arrayed Waveguide Grating (AWG) is a passive optical component, which have found applications in a wide range of photonic applications including telecommunications and medicine. Silica-on-Silicon (SoS) based AWGs use a low refractive-index contrast between the core (waveguide) and the cladding which leads to some significant advantages such as low propagation losses and low fiber coupling losses between the AWG waveguides and the fibres. Therefore, they are an attractive DWDM solution offering higher channel count technology and good performance characteristics compared to other methods. However, the very low refractive-index contrast means the bending radius of the waveguides needs to be very large (on the order of several millimeters) and may not fall below a particular critical value to suppress bending losses. As a result, silica-based waveguide devices usually have a very large size that limits the integration density of SiO2-based photonic integrated devices. High-index contrast AWGs (such as silicon, silicon nitride or polymer-based waveguide devices) feature much smaller waveguide size compared to low index contrast AWGs. Such compact devices can easily be implemented on a chip and have already found applications in emerging applications such as optical sensors, devices for DNA diagnostics and optical spectrometers for infrared spectroscopy.In this work, we present the design, simulation, technological verification and applications of both, the low-index contrast and high-index contrast AWGs. For telecommunication applications AWG-MUX/Demux with up to 128-channels will be presented. For medical applications the AWG-spectrometer with up to 512-channels will be presented.This work was carried out in the framework of the projects: ADOPT No. SK-AT-20-0012, NOVASiN No. SK-AT-20-0017 and AUTOPIC No. APVV-17-0662 from Slovak research and development agency of Ministry of Education, Science, Research and Sport of the Slovak Republic and No. SK 07/2021 and SK 08/2021 from Austrian Agency for International Cooperation in Education and Research (OeAD-GmbH); and project PASTEL, no. 2020-10-15-001, funded by SAIA..

Keywords: Waveguide, Photonics, Spectroscopy.

INVITED SPEAKERS

Id-531

Unique Features of Non-Ablative ErYAG Laser in Medical Therapies

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Abstract: Erbium YAG 2940 nm laser has the best water absorbed wavelength among all lasers. The wavelength of 2940 nm sits at the very peak of water absorption curve and matches the exact vibrational oxygen-hydrogen stretch frequency of water, resulting in a resonant splitting of water molecules at high local temperatures. This feature makes ErYAG the most efficient (but gentle) ablative laser for surgical treatments in medicine. The same ErYAG laser could be used also in a non-ablative mode when the energy delivered is below the ablation threshold. Using a train of sub-ablative pulses, a special Smooth mode was developed for non-ablative skin resurfacing and tissue remodeling. Aside of well known slow thermal diffusion into the tissue, we recently discover an additional component of interaction of such Smooth non-ablative ErYAG with the tissue – the fast heat shocking of the superficial tissue layers. Sub-ablative micro pulses in the Smooth train are producing high but short lasting temperature pulses – heat shocks which trigger additional biochemical process in the tissue. In comparison with other wavelengths, due to its unique water absorbing feature, the 2940 nm ErYAG laser allows safe delivery of the most intense heat shock-generating thermal pulses. We believe that these superficial heat shocks are activating keratinocytes which then communicate (via paracrine signaling) with fibroblast instructing them to produce new collagen and extracellular matrix, contributing thus to the overall therapeutic effect of this non-ablative ErYAG modality. In past years the use of this Smooth non-ablative ErYAG demonstrated excellent therapeutic effects and high safety in a range of indications like are: skin tightening, various vulvar and vaginal treatments, thermotherapy of snoring and sleep apnea and others.

Keywords: ErYAG Laser; Water Absorption, Non-Ablative, Dual Tissue-Regeneration (DTR); Fast Heat Shocking.

INVITED SPEAKERS

Id-548

Temperature Stability of Fiber Array to Photonics Chip Butt Coupling

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Abstract: A Telecom optical fibers are still being the best transmission medium of digital data and analogue signals for long distance applications. Progress in integrated photonics enables development of photonic chips with new unique properties, circuits of the future, and overcomes current limits in information and communication technologies. The packaging of photonic chips is necessary for taking them out of research laboratories into real implementation in the information and communication technology applications. One important step of packaging is effective coupling of optical radiation between telecom optical fiber with ten microns core dimension and photonic chip optical waveguide with submicron dimensions. For complex photonic chips, it is necessary to couple not one optical fiber but several optical fibers, which are arranged in fiber arrays. In this case, it is necessary to use a 6D positioning system, which allows to optimally adjust the relative position of the photonic chip and the fiber arrays. After setting the optimal relative position of the photonic chip and the fiber array, the process of their fixation follows. One possibility of fixation is gluing with an adhesive in the optical path between the photonic chip and an array of optical fibers with a refractive index close to the refractive index of the optical fiber core. This paper is focused on the experimental test set-up for the temperature characterization of fiber array to photonics chip butt coupling at 1310 nm and 1550 nm wavelengths fixed themselves by UV adhesive in the optical path. The main aims of this works are selection of better adhesive from two types for gluing of photonic chip and fiber array in packaging process of photonics chips and validation of gluing process developing. The coupling and alignment of fiber arrays to photonics chip were done by automated active alignments system and they were fixed themselves by curable epoxy adhesive. Temperature

changes of coupling insertion losses are measured and investigated for two different UV adhesives during three temperature cycles from -40 °C to 80 °C in climatic chamber according to Telcordia. Spectral dependence of insertion losses were measured and compared before and after three temperature cycles for 1530 nm to 1570 nm spectral range at room temperature.

This work was supported by the Slovak Research and Development Agency under the contracts APVV-17-0662 and SK-AT-20-0017 and by the COST Action “European Network for High Performance Integrated Microwave Photonics” (EUIMWP) CA16220.

Keywords: Photonics Integrated Circuit, Fiber arrays, Active Alignment, Temperature, Characterization.

INVITED SPEAKERS

Id-549

Advanced Multispectral and Multimodal Imaging for Skin Diagnostics

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Abstract: Several modalities of digital imaging for in-vivo skin diagnostics have been developed, implemented in prototype devices and clinically validated at the Biophotonics Laboratory of IAPS over the recent years. Starting with a concept device SkImager, intended for multimodal three spectral band reflectance imaging, fluorescence imaging and remote photoplethysmography imaging, we continued with three models of smartphone-based devices equipped with spectrally specific illuminators. A device for fast primary diagnostics of skin melanoma comprising a set of narrowband LEDs for multispectral and fluorescence imaging was developed; combined multispectral and photoplethysmography imaging enabled early diagnostics of sepsis and remote anesthesia control. To improve the spectral selectivity of imaging, a concept of multi-spectral-line imaging was proposed and implemented in prototypes for three and four spectral line imaging, which passed laboratory tests and clinical validation. Currently a project on multimodal non-contact optical skin diagnostics by combining triple spectral line imaging with fluorescence lifetime imaging and Raman spectral band imaging is under development.

This work was supported by the ERDF project #1.1.1.1/18/A/132 “Multimodal imaging technology for in-vivo diagnostics of skin malformations”.

Keywords: Skin Diagnostics, Spectral Imaging, Fluorescence.

INVITED SPEAKERS

Id-550

Optical Characterization of Spin Coated Ag/Polymer Nanocomposite Film on Soda-Lime Glass Substrate

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Abstract: Optical properties of metal nanoparticles (MNP) are dominated by localised surface plasmon resonance (LSPR), presenting absorption around characteristic wavelength. This property is employed in devices such as absorbers, sensors or colour filters. For many applications it is beneficial to have intensive LSPR peak. Its intensity is related with concentration, size and size distribution of metal nanoparticles. Among other ways, MNP layers are prepared by spin-coating of metal containing solutions. In this case, the absorption of the layer may be limited by the maximal attainable layer thickness. The substrate most frequently used for optical purposes is glass. Common glasses consist mainly of silica and alkalies (Na, Ca, K, Mg), that content may easily reach up to 30%. Some of the methods used to improve glass surface properties important for wet chemistry methods are plasma cleaning or chemical surface functionalization. In this work we are proposing glass poling (GP) as a new approach for increasing efficiency for Ag NP coating on glass. GP is depleting glass surface layer from alkali species by application of electric field and elevated temperature. The depleted region is maintained until glass is heated close to its transition temperature. Pieces of microscope soda-lime glass slides and UV grade quartz glass were used as substrates. Poling conditions were 300^{o}C and 500V applied for 1 hour. A part of each substrate was left uncovered by the electrode, so there was no poling. This part will be referred as virgin area. The solution used for spin coating was a mixture of $AgNO_3$, PVP (Polyvinylpyrrolidone) and acetonitrile. After spin-coating of the solution onto the poled substrate, the samples were annealed in air for 20min at 200^{o}C. The optical properties of the samples were analysed by spectroscopic ellipsometer. Transmittance was measured by the same instrument. Soda-lime sample clearly presents visible difference between poled and virgin area; poled area has more intense yellowish coloration in transmittance. Poled part transmittance minimum is deeper and the difference in the minimum is 25%. Plasmon peaks obtained from ellipsometry measurements confirm that absorption is stronger in poled region. Since the thickness of layers is the same at the whole surface of the sample and plasmon peak weaker at the virgin than poled area, it is suggested

that there is less NP in the layer covering virgin than poled area. However, in the case of quartz glass substrate there is no difference in plasmon peak regardless if poling was done or not. Coating by the described wet chemistry method involves unwanted ion exchange between the virgin soda-lime substrate and the solution: Ag from the solution is exchanged by Na (the most mobile alkali ion in glass) resulting in less metal in the layer. Quartz glass does not contain alkalies, and therefore there is no loss of Ag from the layer. Since the surface layer of poled glass does not contain alkali ions either, the coated layer remains rich with Ag ions forming films with high NP concentration and intense LSPR peak.

This work was financed by Croatian Science Foundation under the project no. IP-2016-06-2168.

Keywords: Glass Poling, Silver Nanoparticles, Sol-Gel, Ellipsometry, Ion Exchange

INVITED SPEAKERS

Id-553

Mechanical Nano-Manipulation for the Novel Single Photon Sources with Hybrid Nanoantennas

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Abstract: The practical implementation of nanophotonic building blocks of future quantum technology and communication relies on the development of ultrafast highly efficient and reliable quantum emitters. Solid-state emitters of single photons operating at room-temperature face different challenges. Particularly, the plasmonic nanoantennas based on nanoparticles-on-metal nanopatch antennas, (NPA) are extremely relevant in this regard. Unfortunately in many cases standard top down lithography cannot be used for such structures creation. In the report the general overview of application of nano-integration technologies for nano-photonics will be given and concrete application of hybrid NPA and submicron cavity quantum light source with enhanced radiation performance will be described. We demonstrate the new hybrid system formed by two coupled resonators and emitters. We use focus ion beam (FIB) nanolithography to fabricate an ordered array of pits, which were then filled with colloidal silver nanocubes and quantum dots (QD). Using confocal microscopy, we show that the QD spontaneous emission time in the hybrid nano-antenna is reduced to 22 ps and the fluorescence intensity of emitters is increased by more than three times. We also demonstrate how the metallic walls of the external resonator affect the behavior of the NPA plasmon resonance and the QD emission. The reported results prove that an ordered system of nanoantennas with a high emission intensity and rate can be created.

Keywords: Quantum Emitters, Hybrid Nano-Antenna; Focus Ion Beam; Plasmon; Confocal Microscopy, Mechanical Nano-Manipulation.

INVITED SPEAKERS

Id-558

Green-Emitters $Ca_8ZnGd_{1-x}Tb_x(PO_4)_7$ with β-$Ca_3(PO_4)_2$-Type Structure

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Abstract: Inorganic materials with intense luminescence are widely applied in lighting, security systems, medicine, high energy physics, etc. The requirements for their properties depend on the potential application and can differ significantly. However, for the overwhelming majority of phosphors a high light output and temperature stability of luminescence intensity are important. One of the approaches to obtain an effective phosphor is doping of rare-earth ions in the host matrix. Phosphates with the whitlockite-type structure are perfect candidates as matrix for realization the luminescence properties of Tb^{3+} ions as a green emitter, for instance. The whitlockite-type structure phosphates $Ca_8ZnGd_{1-x}Tb_x(PO_4)_7$ ($0 \leq x \leq 1$) were prepared by standart solid-state reaction from $CaHPO_4 \cdot 2H_2O$, $CaCO_3$, R_2O_3 (R – Gd, Tb), ZnO, as a starting materials. Synthesis was carried out in the air for 120 hours with an intermediate mixing at 1100°C. Powder X-ray diffraction (PXRD) patterns for all samples were compared with previously reported $Ca_9Gd(PO_4)_7$ (PDF Card No. 49-1086). All samples were single-phased and belonged to the β-$Ca_3(PO_4)_2$-type structure. The determined space group was R-3c due to the absence the second harmonic generation (SHG) signal. On photoluminescence emission spectra, monitored at 369 nm, the number, and positions of bands, corresponding to 4f-4f transitions of only Tb3+ ions, were not changed depending on x, concentration of Tb^{3+}. However, the intensity was differing. The highest value of the integral intensity was observed for x = 0.9 in $Ca8ZnGd_{1-x}Tb_x(PO_4)_7$. It is indicating a presence of concentration quenching phenomena. Also, the transitions from excite level $^5D_3$ are depressed in samples with x > 0.25 due to cross relaxation processes. Color characteristics (CIE coordinates) are taken value (0.317; 0.592). These values are in green region of visible spectrum.

This work was supported by Russian Science Foundation (19-77-10013).

Keywords: β-$Ca_3(PO_4)_2$, Whitlockite, Tb^{3+} Luminescence, Green Emitter, LED

INVITED SPEAKERS

Id-559

SERS Substrates from Inverse Opal Photonic Crystal Films

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Abstract: Composite photonic crystal films with Au nanoparticles were obtained by inversion of opal templates using a photocurable resin followed by double impregnation with a gold colloidal solution. The surface enhanced Raman scattering (SERS) signal was analyzed as a function of the photonic stop band spectral position using the methylene blue dye as a test compound. It was shown that a coincidence of the photonic stop band center with the Raman laser wavelength leads to an enhancement of Raman scattering by a factor of 20. The overall enhancement factor was more than 10^5 in this case, and the detection limit for methylene blue in solution was on the order of 10^{-7} M. The combination of large and reproducible enhancement factor, low analyte consumption and moderate gold concentration (~0.6 μg/mm^2) makes our samples very promising for use as Raman sensors.

The research was performed using the equipment of the JRC PMR IGIC RAS. The work was supported by the Russian Foundation for Basic Research (Project Number 19-33-90266) and the RF President Grant for Leading Scientific Schools (Grant Number 2726.2020.3).

Keywords: Photonic Crystal, Inverse Opal, SERS, Au Nanoparticles, Detection Limit.

INVITED SPEAKERS

Id-561

Creating CNT Based Devices for Nanophotonics, Nanoplasmonics, Metasurfaces, THz Generation Using Nano-Manipulation

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Abstract: Carbon nanotubes (CNTs) are almost ideal one-dimensional (1D) nanoobjects with outstanding mechanical, electrical, optical and many other properties which are inherent to them both in the form of individual nanoobjects and in the form of various arrays of CNTs. Recently CNTs are recognized as very promising materials for nano-optics, including nanoantennas, nano-rectennas, plasmonics, nanophotonics, optoelectronics, luminescence, light and terahertz radiation, cold field emission, as well as building blocs for metamaterials, metasurfaces, and nanofluids. Many efforts currently is directed to creating CNT based devices for emitting single photons, generating and detecting THz, tunnel resonant diodes, field-effect transistors etc. In this issue, both single CNT nanodevices and phenomena associated with various CNT arrays are being intensively studied. But both for the fundamental study of CNTs and for applications in all these areas of research, it is often required to work with an individual CNT. So it is critically important to select CNTs and control their placement in the desired structures and architectures in the installation or device. The report provides a brief overview of the results of studies of CNTs based structures in nanophotonics, nanoplasmonics, nanooptics, etc. and shows the expanding prospects of these studies using mechanical nanomanipulation with CNTs. The latest experiments carried out by the authors are cited as examples of the creation of CNT metasurfaces and plasmonic CNT nanodevices generating THz radiation.

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Keywords: Carbon Nanotubes, THz, Electromagnetic Waves, Nanoplasmonics, Nanomanipulation.

INVITED SPEAKERS

Id-563

Luminescent Phosphors as Optical Temperature Sensing Materials

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Abstract: Optical temperature sensing is a promising method to achieve accurate thermal sensing in the field of many technological applications such as micro/nano electronics, nuclear reactors, biological and medical systems, aero or automobile engines, energy and power industries, where traditional contact thermometers cannot be used effectively. In recent years, optical thermometer applications based on the luminescence properties of non-contact phosphors have received wide attention due to their high sensitivity, spatial resolution, and temperature accuracy even in nuclear, electromagnetic, or high-voltage power environments. In many optical measurements, the fluorescence intensity ratio (FIR) technique of two thermally coupled levels of rare earth (RE^{3+}) ions is a potential candidate for optical temperature technology with high accuracy and fast response time. In this presentation, the temperature-dependent luminescence characteristics of Yb3+/Er3+ codoped gadolinium gallium garnet ($Gd_3Ga_5O_{12}$), cadmium niobate ($CdNb_2O_6$), and Lanthanum titanium oxide ($La_2Ti_2O_7$) phosphors are summarized using the FIR method. The up-conversion (UC) luminescence upon 975 nm excitation is investigated and the optical temperature-sensing properties are evaluated for optical thermometers. Experimental observations of the temperature dependence of UC emission intensities and the sensitivities will be presented in the temperature range of 300−973 K. This study was financially supported by the Scientific Research Project Commission of Marmara University with the grant number FEN-E-090517-0276. Ege University Scientific Research Projects Coordination Unit supported the synthesis of GGG nanophosphors with a 14-FEN-027 project number.

Keywords: Luminescence Thermometry, Temperature Sensing, Phosphors, Upconversion, Sensitivity.

REGULAR SESSIONS

Id-532

Increased Popularity of Picosecond Lasers in Aesthetic Medicine

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Abstract: In the last couple of years picosecond lasers are becoming more and more popular in the aesthetic field, especially for indications like are: tattoo and pigmentations removal, skin rejuvenation and scar revision. The manufacturers claim that picosecond lasers have much better efficacy and safety than previously used nanosecond (Q-switched) lasers. These superior features were attributed to stronger expressed photo-mechanical interaction of picosecond pulses with the target chromophores in comparison to longer nanosecond pulses and consequently less heat developed reducing thus potential issues with post inflammatory hyperpigmentations. However, since their appearance there ware controversies and critical reviews of the manufacturers' claims about the superiority of pico lasers in comparison with nano and quite some studies were showing that initial claims were exaggerated. As the pico technology was maturing, the pulse durations were getting shorter (from 750 ps to 300 ps), the energies per pulse higher (from 200 mJ to 800 mJ) and the benefits of pico lasers started to show their right value. Also most of the manufacturers introduced fractional handpieces which are producing a set of micro-beams instead the full spot ones, usually with the focal plane beneath the skin surface, with the aim to produce so called Laser Induced Optical Breakdown (LIOB). The LIOBs are creating micro-wounds beneath the skin surface, through the healing of which the tissue rejuvenation is achieved, while the skin surface integrity is preserved. Due to its gentleness and safety picosecond fractional treatments with LIOBs become very popular, especially in the markets with population with sensitive skin.

Keywords: Picosecond Laser, Photo-Mechanical İnteraction, Q-Switched Laser, Fractional, Laser Induced Optical Breakdown (LIOB).

POSTER SESSIONS

Id-544

Study of Human Platelets Spectral Homogeneity by Sers Technique

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Abstract: We have performed a detailed study of human platelets spectral homogeneuty using Surface-enhanced Raman spectroscopy technique. A combined approach based on multivariate methods as principal component analysis and pair correlation algorithms has been applied to investigate platelet's spectral properties. 15 blood samples were taken from one healthy volunteer in 6 different days within two-week period. SERS spectra were obtained by Centaur U (“NanoScanTechnology Ltd., Russia) Raman spectrometer, using 532 nm DPSS Cobolt Samba excitation laser with 45 mW power on sample. The main idea of the paper was to investigate the spectral «similarity». Spectral correlation can be a fairly simple way to widespread measure for this problem. Performing Principal Component Analysis (PCA) as a first way, the principal component scores (PC) were set. The output variables (PC1, PC2, PC3) were used to describe spectral differences in the platelet spectral data. We used the Mahalanobis distance as a specific parameter inside the spectra to determine the similarity of Raman spectra. Calculated Mahalanobis distances for 91 spectra were not more than 5 and for three spectra were 14, 32, and 91. It had shown a minimum deviation for 97% of the spectral set. Since Mahalanobis distance approach relies on the reasonable intuition that a good similarity function should assign a large (respectively small) score to pairs of points of the same class, we can conclude that the platelet spectra are highly homogeneous. Our study performs new results for platelets spectral homogeneity analysis using SERS and statistical methods for the healthy person. As a result, the high degree of spectral homogeneity of Raman platelet spectra for the samples with healthy volunteers has been demonstrated. The study has been performed with the support of the Ministry of Science and Higher Education of the Russian Federation assignment Nr. 075-02-2021-1748.

Keywords: Human Platelets, SERS, Cardiovascular Deceases, FDTD Simulation.

POSTER SESSIONS

Id-551

Spectroscopic Ellipsometry Characterization of Glass Poling and Electric Field Assisted Dissolution Processes

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Abstract: The potential of spectroscopic ellipsometry to investigate the dynamics of glass poling and electric field assisted dissolution of nanoparticles and films is demonstrated. These processes produce in-depth sample composition variations that are usually characterized by lengthy and destructive techniques. However, these changes also affect the sample optical response and therefore can be detected by a high-sensitive technique such as ellipsometry. The benefits of ellipsometry in retrieving relevant information are shown in three case studies: glass poling of microscopy slides, dissolution of Ag nanoparticles embedded in SiO_2 films and metal-doping of a dielectric layer on top of a glass slide.

This work was financed by the Croatian Science Foundation under the project no. IP-2016-06-2168.

Keywords: Spectroscopic Ellipsometry, Glass Poling, Electric Field Assisted Dissolution, Metal Nanoparticles, Optical Characterization.

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