Book of abstracts

PHOTONICA2021

VIII International School and Conference on Photonics

& HEMMAGINERO workshop

23 - 27 August 2021,

Belgrade, Serbia

Editors

Mihailo Rabasović, Marina Lekić and Aleksandar Krmpot

Institute of Physics Belgrade, Serbia

Belgrade, 2021

ABSTRACTS OF TUTORIAL, KEYNOTE, INVITED LECTURES, PROGRESS REPORTS AND CONTRIBUTED PAPERS

of

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Dear Colleagues, friends of photonics,

We are honored by your participation at our PHOTONICA 2021 and your contribution to the tradition of this event. This year PHOTONICA will be a hybrid event. It means the Conference will comprise both an in-person conference and a virtual conference. Welcome to the world of photonics.

The International School and Conference on Photonics- PHOTONICA, is a biennial event held in Belgrade since 2007. The first meeting in the series was called ISCOM (International School and Conference on Optics and Optical Materials), but it was later renamed to PHOTONICA to reflect more clearly the aims of the event as a forum for education of young scientists, exchanging new knowledge and ideas, and fostering collaboration between scientists working within emerging areas of photonic science and technology. A particular educational feature of the program is to enable students and young researchers to benefit from the event, by providing introductory lectures preceding most recent results in many topics covered by the regular talks. In other words, tutorial and keynote speakers will give lectures specifically designed for students and scientists starting in this field. Apart from the oral presentations PHOTONICA hosts vibrant poster sessions. A significant number of best posters will be selected and the authors will have opportunity to present their work through short oral presentations – contributed talks.

The wish of the organizers is to provide a platform for discussing new developments and concepts within various disciplines of photonics, by bringing together researchers from academia, government and industrial laboratories for scientific interaction, the showcasing of new results in the relevant fields and debate on future trends.

PHOTONICA 2021 will host HEMMAGINERO workshop which is dedicated to hemoglobin and erythrocytes imaging and spectroscopy in various aspects. The Workshop is related to HEMMAGINERO project funded by the Science fund of Republic of Serbia, within PROMIS program. In addition, the representatives of the companies related to photonics will have significant role at the event by presenting the new trends in research and development sector. Following the official program, the participants will also have plenty of opportunities to mix and network outside of the lecture theatre with planned free time and social events

This book contains 161 abstracts of all presentations at the VIII International School and Conference on Photonics, PHOTONICA2021. Authors from all around the world, from all the continents, will present their work at this event. There will be five tutorial and seven keynote lectures to the benefits of students and early stage researches. The most recent results in various research fields of photonics will be presented through sixteen invited lectures and twelve progress reports of early-stage researchers. Within the poster sessions and a number of contributed talks, authors will present 122 poster presentations on their new results in a cozy atmosphere of the building of Serbian Academy of Science and Arts.

Belgrade, August 2021

Editors

Contributed papers

1. Quantum optics and ultracold systems
2. Nonlinear optics
3. Optical materials
4. Biophotonics
5. Devices and components
6. Optical communications
7. Laser spectroscopy and metrology
8. Ultrafast optical phenomena
9. Laser - material interaction
10. Optical metamaterials and plasmonics
11. Machine learning in photonics
12. Other topics in photonics

Mapping of fluorescent compounds in lyophilized blackcurrant (*Ribes nigrum L.*) fruits using spectroscopy and nonlinear microscopy

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Blackcurrant (Ribes nigrum L.) belongs to the important medicinal plants that act preventively and therapeutically on the organism [1, 2]. Bioactive components in fruits and leaves of blackcurrant could have beneficial effects on the skin fibroblasts that produce collagen [3]. The influence of parts and extracts of this plant on erythrocyte membranes has been the subject of research in recent years [4]. Blackcurrants (Ribes nigrum L.) contain high levels of polyphenol anthocyanins in fruits and flavonoids in leaves that have beneficial effects on health, owing to antioxidant and anticarcinogenic properties. These compounds are responsible for the coloring of many plants, flowers and fruits. Cyanidin-3-O-glucoside (C3G) is one of the principal types of anthocyanidins and is the most common and abundant one in fruits blackcurrant [5]. Anthocyanidins/anthocyanins can be employed as probes for oxidation processes in biomedical experiments. Their advantages include biocompatibility and the lack of toxicity [6].

The present study aimed to present the analysis and mapping of the Blackcurrants (Ribes nigrum L.) components using spectroscopy and imaging measurements [1, 7]. Time resolved optical characteristics were analyzed by using TRLS (Time Resolved Laser Spectroscopy) experimental setup [1]. Nonlinear optical properties of the plant have been studied using two-photon excited autofluorescence (TPEF), and upconversion luminescence (UCL) simultaneously [7]. The benefits of using UCL for biological applications are in reducing the photobleaching and providing photostability. Upconversion emission is also more efficient than the TPEF and SHG. Moreover, UCL could be achieved with a low power continuous wave (CW) laser.

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Effects of laser heating on luminescent properties of Gd_2O_3:Er,Yb nanophosphor

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In this study we analyze effects of laser heating on luminescent properties of nanocrystalline Gd_2O_3 doped with Er^{3+} and Yb^{3+} cations. Material was synthesized by combustion method, as described in [1]. Our experimental setup is presented in detail in [2,3,4]. In this study we have used pulsed laser diode excitation at 980 nm. Variable laser pulse energy was obtained by varying the laser pulse duration. Used laser diode has both continual and pulse mode. In continual mode its power is 1 W; in pulse mode it is possible to tune pulse duration and repetition, thus obtaining different average excitation powers. Here, we have used repetition rate of 200 Hz, with varying pulse duration between 20 µs and 200 µs, so average excitation power is between 8 mW and 80 mW.

Generally, laser power heating effects are unwanted and should be avoided in luminescence thermometry experiments; external heater and thermometer are used to calibrate the temperature sensing curve. Interestingly enough, the thermometry system, based on laser heating of sample, applicable for biomedical purposes, is described in [5].

Luminescence spectra of $Gd_2O_3:Er^{3+},Yb^{3+}$ excited at room temperature with different laser excitation powers are shown in Figure 1. It should be noted that excitation power is intentionally much higher than used in [3]. Based on temperature sensing calibration curve presented in [3] for the same sample it could be estimated that the material is locally heated to about 375 K for pulse time of 200 µs.

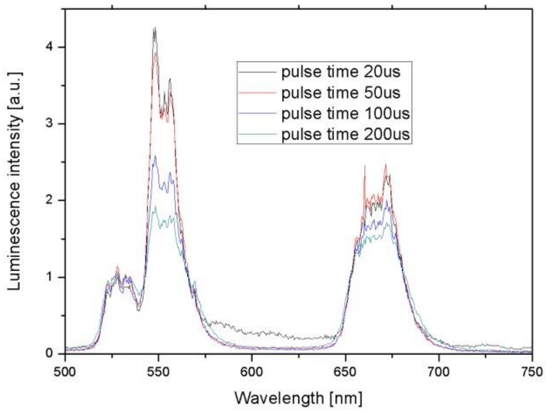

Figure 1. Luminescence spectra of $Gd_2O_3:Er^{3+},Yb^{3+}$ excited at room temperature with different laser powers.

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Using SOLO software package for classification of temperature dependent luminescence spectra

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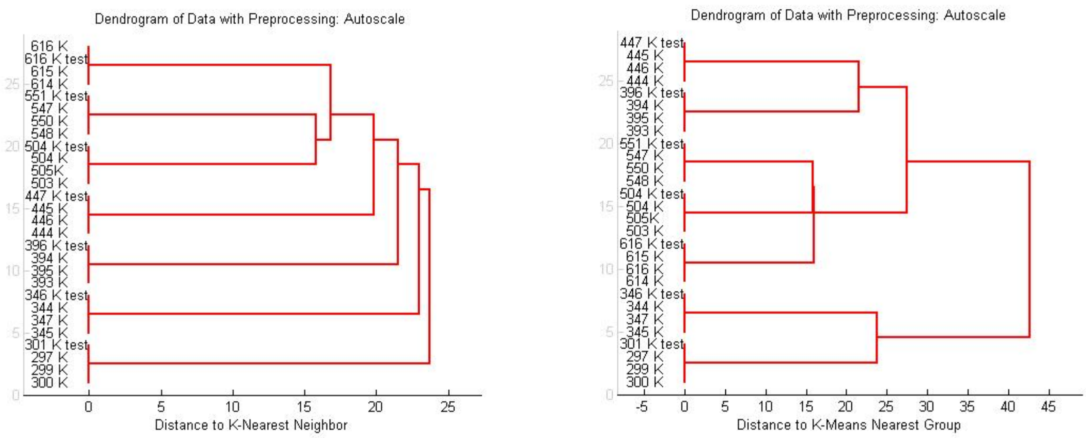
In this study we use SOLO software package (Version 8.8, Eigenvector Research Inc, USA) for classification of temperature dependent luminescence spectra of nanocrystalline Gd_2O_3 doped with Er and Yb. Material was synthesized by combustion method, as described in [1]. Our experimental setup is presented in detail in [2,3]. In [4,5] we have used Principal Component Analysis of luminescence spectra of thermophosphors; here, we use classification tools based on more sophisticated K-Nearest Neighbor and K-Means Nearest Group algorithms.

Classification results (shown as dendrograms) of luminescence spectra of $Gd_2O_3:Er^{3+},Yb^{3+}$ at different temperatures using K-Nearest Neighbor and K-Means Nearest Group algorithms are shown in Figure 1. Although dendrograms are different, the groups determined by both methods are the same; moreover, the test luminescence spectra are also classified in temperature groups where they belong. So, the machine could be trained to differentiate spectral data obtained on different temperatures.



(a) (b)

Figure 1. Classification results (shown as dendrograms) of luminescence spectra of $Gd_2O_3:Er^{3+},Yb^{3+}$ at different temperatures using (a) K-Nearest Neighbor and (b) K-Means Nearest Group algorithms.

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