The 1st Serbian Conference on Materials Application and Technology - SCOM

BOOK OF ABSTRACTS

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SCOM 2022

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Belgrade, Serbia, 20th - 21st of October 2022

Dear Colleagues and Friends,

It is our great pleasure to welcome you to the first Serbian Conference on Materials Application and Technology - SCOM2022. The conference is jointly organized by the Society for Science Development of Serbia and the Vlatacom Research and Development Institute. With a focus on cutting-edge materials design, fabrication, and integration as well as ground-breaking materials-based technologies, SCOM2022 is the new home for all materials-related technological research. This conference will highlight the most recent advancements in the field of materials technology and application aiming to bridge the gap between researchers working on materials and technology users. Energy, healthcare, electronics, optics, microfluidics, sensors, food safety, and other topics will be covered. This year, three tutorial lectures, two invited lectures, and 16 oral presentations on the following topics will be given: Nanomaterials, Biomaterials, Optical and Photonic Materials, Materials for energy production and storage, Chemo/Bio/Physical Engineering, Photocatalysis, Green technologies, Sensor materials and technologies, Materials synthesis and processing.

We anticipate that SCOM2022 will be fruitful in terms of scientific exchange and that it will strengthen existing collaborations among participants while also fostering future ones. We would like to thank various organizations for their financial assistance.

Organizers of the SCOM2022 wish you a nice time during the conference in Belgrade!

Conference Chairperson

Prof. Dr. Miroslav D. Dramićanin

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SCIENTIFIC SOFTWARE FOR LUMINESCENCE BY OMAS GROUP

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Luminescent materials, simply called phosphors, are used in multi-billion-dollar industries of LEDs, displays, fluorescent lamps, lasers and optical sensors. Our group OMAS which is an abbreviation for Optical Materials and Spectroscopy investigates the fundamental properties of phosphors and their applicability for LEDs, lasers, and temperature sensing.

Temperature causes changes in all spectral features of phosphors. If the activator ion in phosphor material is a lanthanide, then intensities, quantum efficiencies and radiative lifetimes can be theoretically predicted by the Judd-Ofelt theory. By using theoretical models of temperature-dependent spectral characteristics and Judd-Ofelt theory, one can predict, simulate, and explain the properties of the phosphor light emission. However, there are numerous models and equations that may differ among various materials. Thus, doing the above-mentioned task manually is cumbersome to say at least, and in some cases even impossible. The scientific and industrial progress in modern times greatly relies on collaboration with IT, which is also the path the OMAS group undertook as a solution to this problem. For every computationally difficult task the OMAS group encountered in research, the specialized software is built to help resolve it, and the solution was always shared with other researchers in a form of publications, data shares, and via www.omasgroup.org. All the software that was developed by the OMAS group will be presented here.

LumTHools is the most recently published stand-alone desktop application for modelling the temperature-dependent phenomena in luminescence and luminescence thermometry. It fits the experimental data to one of the many theoretical functions and provides the needed physical parameters and figures of merit. It was built in python and Java. OMAS used Mathematica and MATLAB for many functions and applets. So far these small applications are capable of modelling temperature dependence of Mn^{4+} emission decay and application to the luminescence thermometry, interactive simulation and evaluation of the performances of the sensor probe by the luminescence intensity ratio method and Judd-Ofelt theory, predicting the phosphor emission colour by Eu^{3+} spectrum simulation from the Judd-Ofelt theory, and software for deconvolution of overlapping peaks of transition metals at multiple temperatures. To be able to apply the Judd-Ofelt theory for spectroscopic analysis, it is necessary first to obtain the 3 Judd-Ofelt parameters. This is done from a single spectrum, but various methods are depending on the investigated lanthanide ion. We have published PHP calculators of the Judd-Ofelt parameters on the OMAS group website for parametrization from the excitation spectrum of Eu^{3+} and the emission spectrum of Pr^{3+}. JOES is a stand-alone desktop Java application for complete Judd-Ofelt analysis from the emission spectrum of Eu^{3+}. OMAS group also programmed ATMEL microcontrollers for various tasks: for control of LEDs to obtain the desired spectrum or for heating/cooling stages.

OMAS group over the course of several years published many, multiplatform, open source, free software using python, Java, PHP, Mathematica, C++ or MATLAB, for applications in luminescence analysis, thermometry, simulations or control of electronics. The software was published in prestigious journals and rewarded with a high number of citations.

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