

New materials in electrical and electronic engineering section (NMI)

INVITED PAPER:

"How to use sound as a powerful tool for new material characterization"

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Abstract: This paper will discuss the basics of photoacoustics: the generation of sound waves by the sample illuminated with the modulated light source, and their application within the characterization of materials in the solid phase. Among the many sound components that arise during the modulated illumination of the sample, the thermoelastic component is very grateful for the establishment of a generalized model for the characterization of the solid. The simplest analysis of the thermoelastic component in the frequency domain, based on electro-acoustic analogies, gives a relationship between the characteristic cut-off frequency of the mentioned component and the corresponding thickness of the illuminated sample. The proportionality coefficient in this relationship represents the thermal diffusion coefficient for the given sample material. It can be shown that such simple relations can be established for any material in the solid phase, which allows one to establish a generalized method of material characterization. It turns out that this method is quite reliable and precise, and that it can be used in various branches of science and industry, from the analysis of new materials to material quality control in the microelectronics and optoelectronics industry.

Short Bio:



Dr. Dragana Kitan Markushev was born on July 3, 1973. in Niš, where she completed elementary and high school. At the Faculty of Science and Mathematics in Pristina in 1999, she obtained the title of graduate physicist, and at the Department of Physics - Faculty of Science and Mathematics in Niš, on February 14, 2005. she earned the title of graduate professor of physics and general technical education. She received her doctorate on 05.05.2021. at the Faculty of Electronics in Niš, Department of Microelectronics. She obtained the title of scientific associate in natural and mathematical sciences - physics on 15.10.2021.

From 03.12.2021. she has been employed at the Institute of Physics in Belgrade, in the Photoacoustics Laboratory. Her scientific and teaching activities are focused on the analysis of processes related to light absorption, non-radiative relaxation, and heat transport in all types of illuminated materials (semiconductors, metals, plastics) of different structures (homogeneous and inhomogeneous, composite materials, thin films, multilayer structures) and on at all levels (macro, micro, nano). She is involved in developing methods and techniques for characterizing materials used in MEMS and NEMS structures for a wide range of applications, from electronics and measurement systems to environmental protection. She is particularly interested in applying machine learning and neural networks to develop efficient experimental methods for real-time thermal characterization of materials using photoacoustics.

In the most general sense, her areas of interest and research are photothermal sciences, photoacoustics, physics of semiconductors and nano-materials, electro-acoustic analogies, machine learning, neural networks, heat transport, microelectronics, photonics, and environmental protection.