University of Belgrade
Institute of Physics Belgrade
Kopaonik, March 13-16, 2022

Book of Abstracts

15th Photonics Workshop

(Conference)

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Kopaonik, Serbia, March 13-16, 2022

Publisher, 2022:

Institute of Physics Belgrade

Pregrevica 118

11080 Belgrade, Serbia

Editors:

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ISBN 978-86-82441-55-7

Printed by:

NEW IMAGE d.o.o.

Tošin Bunar 185, Belgrade

Number of copies: 55

CIP - Каталогизација у публикацији - Народна библиотека Србије, Београд

535(048)

681.7(048)

66.017/.018(048)

PHOTONICS Workshop (15; 2022; Kopaonik)

Book of Abstracts / 15th Photonics Workshop, (Conference), Kopaonik, March 13-16, 2022; [editors Dragan Lukić, Marina Lekić, Zoran Grujić]. - Belgrade: Institute of Physics, 2022 (Belgrade: New image). - 72 str.: ilustr.; 25 cm

Tiraž 55. - Registar.

ISBN 978-86-82441-55-7

a) Оптика - Апстракти b) Оптоелектроника - Апстракти c) Технички материјали - Апстракти

COBISS.SR-ID 60055049

Using artificial neural networks to make temperature sensing calibration curve

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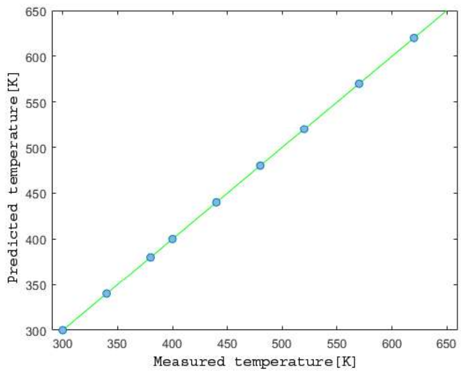
Abstract. In this study we analyze possibilities of determining the temperature sensing calibration curve of thermophosphors using artificial neural networks (ANN). For machine learning analysis of data we have used Solo+Mia software package (Version 9.0, Eigenvector Research Inc, USA). Experimental results were obtained using experimental setup presented in detail in [1,2]. Upconverting material was excited at 980 nm by using pulsed laser diode. Usual, conventional way is to use intensity ratios of spectral lines for determining the calibration curves for remote temperature sensing [3-5]. Based on thus obtained data we have trained the neural network to recognize temperature of sample based on its luminescence spectrum. For training we have used 69 measured spectral points between 525 nm and 560 nm, so the neural network has 69 input nodes. Although training of neural network took some time (in minutes, on i7 processor based laptop), the neural network provides quick and strait answer when questioned with data of samples heated to unknown temperatures. Predicted values of two unknown temperatures provided by the neural network in Fig. 1. are about 401 K and 572 K. This kind of approach is very versatile, and, if needed, improved by deep learning.



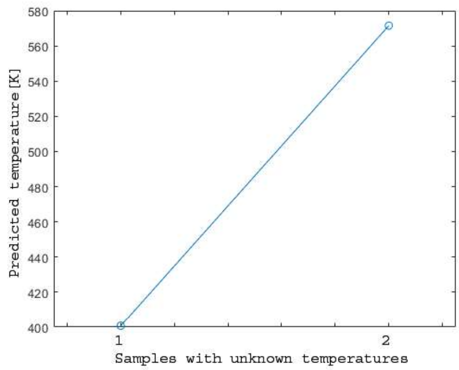


Figure 1. Temperature sensing calibration curve obtained by ANN, simulated by SOLO software (left), predicted temperatures of samples heated to unknown temperatures (right).

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Photonic, electronic and ionic collisional data represented in Belgrade database for inner-shell excitation and ionization of atoms

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Abstract. The inner-shell excitation and ionization of atoms have been extensively studied during past 60 years, primaraly owing to the development of spectroscopic methods used by synchrotron radiation and in less extent by electron impact. Different kind of photonic, electronic and ionic data have been covered by VAMDC and RADAM [1] consortia. Our aim is to develop a possibility of storing ejected electron spectra obtained either by photoelectron or electron spectroscopy methods in which recorded electron intensities are shown versus incident photon/electron energy or kinetic energy of ejected/scattered electrons. A specific database designed for the curation of such spectra is BeamDB – Belgrade Electron Atom/Molecule DataBase [2] with the example of the spectrum given in Fig.1.

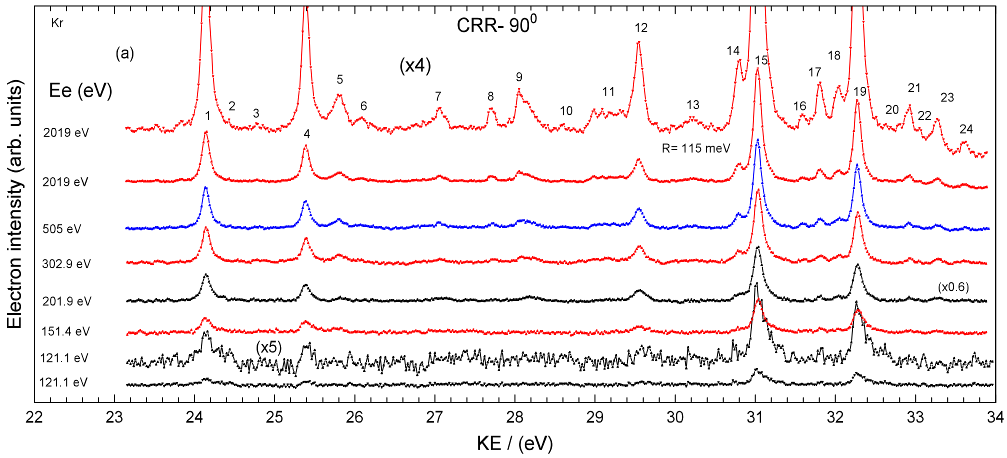

Figure 1. An example of the ejected-electron spectrum of Kr in the 22-34 eV range obtained at electron impact energies from 121.1 to 2019 eV [3].

The interpretation of spectra is complicated not only by configuration interaction in the initial states but also by the fact that often the binding energies of neither the initial nor final states are known accurately. De-excitation pathways due to Auger transitions may lead to multiple ionized atomic species (for Xe atom they have been investigated up to Xe^{6+}) [4].

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