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Database hosted photoelectron spectra and their analysis using machine learning methods: neural network approach

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Abstract. Our aim is to develop a project for a particular spectra identification where spectra are obtained either by photoelectron or electron spectroscopy methods in which recorded electron intensities are shown versus either incident photon/electron energy or kinetic energy of ejected/scattered electrons. Spectra are massively collected and curated within databases [1]. 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.

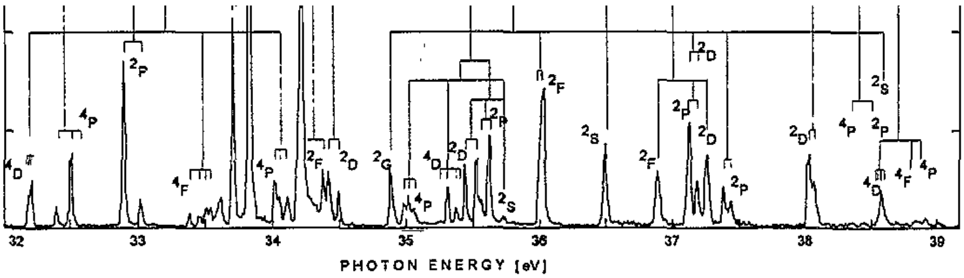

Figure 1. An example of the threshold photoelectron spectrum of argon in the 32-39 eV range [from 3] digitized and contained within BeamDB.

The analysis of spectra is based on machine learning algorithms (Artificial Neural Network- ANN) [4] and the previous knowledge on expert systems for Threshold Spectra Analysis [5] and ANN for the verification of a person using a fingerprint [6]. In our future work we will utilize a training of ANN by using the leaky rectified linear unit activation function. The difference between predicted value and actual value (error) will be propagated backwards to adjust the weights of the network. In order to employ ML algorithms we will need to enlarge the number of spectra that are contained within the BeamDB [7].

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Host effects on luminescent properties of Er,Yb doped nanophosphors

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Abstract. In this study we analyze nano powders Gd_2O_3, $CaGdAlO_4$, Y_2O_3S and $YAlO_3$, doped with Er^{3+} and Yb^{3+}. Our aim was to examine effects of host matrices on optical emission of erbium. For this purpose the luminescence spectra of all samples were obtained in a continuous series of measurements under the same experimental conditions. Our experimental setup is presented in detail in [1,2]. Materials were excited at 980 nm by using pulsed laser diode. Moreover, the samples were prepared in the same way, by combustion synthesis [3]. We compare the possibilities of using these materials for remote temperature sensing. Intensity ratios of spectral lines were used for determining the calibration curves for remote temperature sensing [4-6]. Luminescence intensity ratios (LIR) were determined in a range from 300 K up to 660 K.

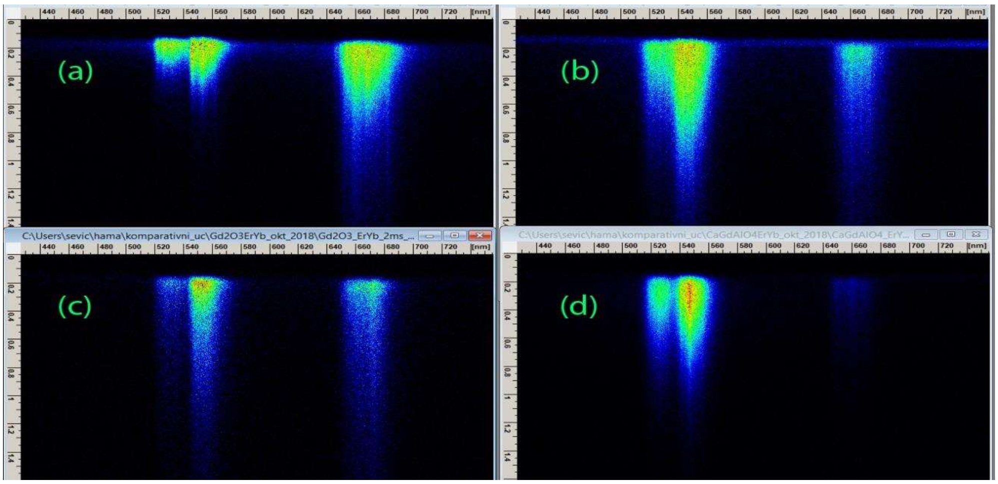

Figure 1. Streak images of (a) Y_2O_3S:Er,Yb, (b) $YAlO_3$:Er,Yb (c) Gd_2O_3:Er,Yb (d) $CaGdAlO_4$:Er,Yb.

Our analysis shows that all synthesized materials are suitable for temperature measurements. In our future work we will analyze prospects of using the erbium optical emission lifetime for temperature sensing.

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