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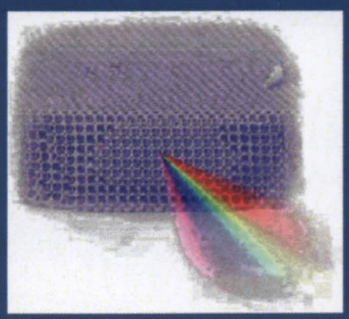
Институт за физику Београд



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Nd:YAG laser ablation of dry bone and soft tissue: a time resolved LIBS study

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Abstract. Lasers are widelly used to ablate the biological materials. For practical considerations in biomedical applications, it is necessary to have a real-time feedback control system, so the discriminating between the ablated layers is possible. The aim of this study is to present the using of Laser Induced Breakdown Spectroscopy (LIBS) for discerning the materials ablated by laser. As excitation laser we use Nd:YAG (1064 nm, pulse width 5 ns, energy of 25 mJ). The diagnostic part of our experiment is based on streak camera, providing us with the time resolved analysis of spectral data. The real application would be based on using the spectrograph with gated acquisition time frame. Our analysis of streak images provides the proof of the concept and determines the value of optimal gate time. We used dry pork bone as experimental sample.

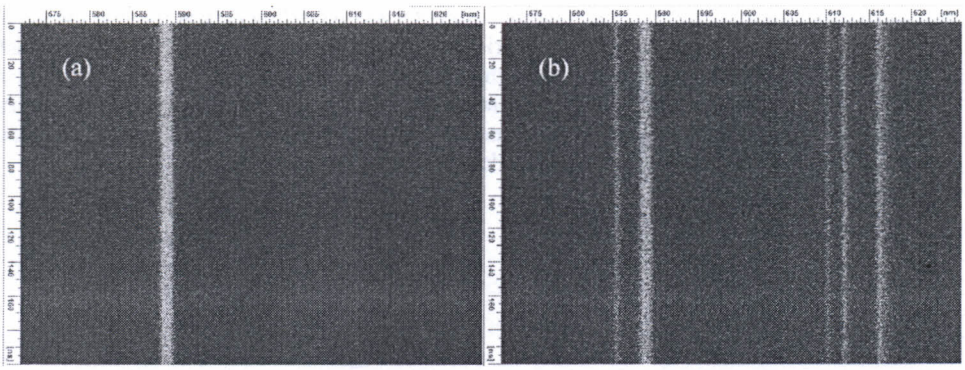

Figure 1. Streak images of LIBS spectra of soft tissue (a) and dry bone beneath it (b). Sodium (Na) line at 589 nm is detected on both images. Calcium (Ca) line at 612 nm is detected on (b). To avoid interferences of plasma continuum emission and air lines the delay time for acquiring the images was 500 ns.

Regarding our LIBS analysis, we follow the line of reasoning presented in [1], where femtosecond laser was used for tissue ablation. Sodium (Na) line at 589 nm and Calcium (Ca) line at 612 nm were chosen for identification of tissues, so the wavelength range of acquired streak images was selected accordingly. Nanosecond Nd:Yag lasers are still widely used for biomedical applications [2, 3]. Our method of time resolved LIBS is presented in [4].

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Fingerprint image enhancement: preliminary study of some computationally efficient approaches

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Abstract. The pattern of ridges and valleys on the finger tip is called a fingerprint. In this way, the fingerprint is defined by the uniqueness of the local ridge characteristics and their relationships. Minutiae points are these local ridge characteristics that occur either at a ridge ending or a ridge bifurcation. A ridge ending is defined as the point where the ridge ends abruptly and the ridge bifurcation is the point where the ridge splits into two or more branches.

It is well known that the enhancement of fingerprint images improves the performance of the fingerprint verification system and makes it more robust with respect to the quality of input fingerprint image [1]. The aim of this study is to present the preliminary analysis of possibilities of using some of the simple approaches for fingerprint image enhancements when original images are not of utmost quality. For our analysis we used computer generated fingerprint images from the data base provided in [1]. The data base was made by using the Synthetic Fingerprint Generator (SFinGe, "sfinge" is Italian for "sphinx"). Many of fingerprint images analysis methods are in one way or another based on Fast Fourier Transform [2-7]. To improve the verification results, more sophisticated techniques could be used [3, 5-7].

a b c d e

Figure 1. Fingerprint images. A fingerprint generated by SFinGe (a) and its FFT (b). The images where bit planes (11111000) (c) and (01111000) (d) were selected, and binary threshold selection (e) offer better visual recognition of ridges and minutiae.

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