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August 27th -31st, 2012, Zrenjanin Serbia

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&
ABSTRACTS OF INVITED LECTURES AND PROGRESS REPORTS

Editors
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DETECTING LEAD USING LASER INDUCED BREAKDOWN SPECTROSCOPY

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Abstract. Lead is ubiquitous in the environment, brought in by human activity. Namely, lead has many useful properties, in particular, ease of production, ease of melting and joining, malleability, and good corrosion resistance. However, it is well known that lead exposure has negative health effects. In this paper preliminary results regarding testing of our LIBS (laser induced breakdown spectroscopy) experimental set-up for detecting lead are presented.

1.INTRODUCTION

Lead has many useful properties, in particular, ease of production, ease of melting and joining, malleability, and good corrosion resistance, so, the lead is ubiquitous in the environment, brought in by human activity. However, it is well known that lead exposure has negative health effects [1].

Many reports, [2-4] and references therein, show that leaded petrol has caused more exposure to lead pollution in human beings than any other single source. Therefore, many countries have outlawed or strictly regulated the use of leaded petrol. In some countries, including ours, the leaded petrol was used until recently. However, it is believed by automotive experts that fuel tanks of obsolete cars (which need lead to lubricate the engine valve seats) still have accumulated lead to last for a few years.

The lead atom was intensively studied in our laboratory using electron spectrometry [5-7].

Our experimental set-up for LIBS and results regarding optical spectroscopy of indium atom are presented in [8-10].

2.RESULTS

A small piece of lead was cut from lead plate. The lead plates are used as counter weights for cone elevator in our experimental apparatus

"ESMA". Streak image of lead LIBS signal and its one dimensional profile are shown in figures 1. and 2. respectively.

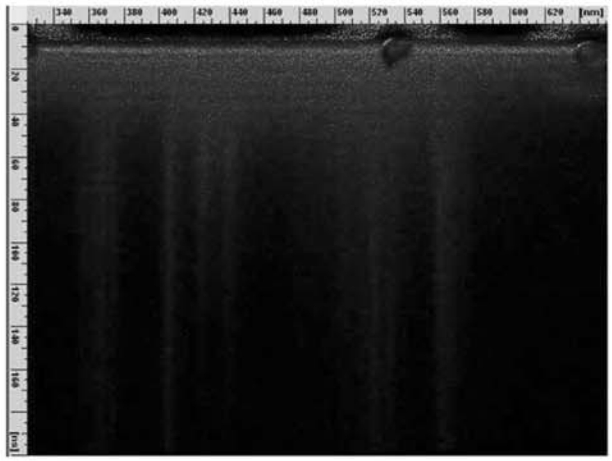

Figure 1. Streak image of lead LIBS signal.

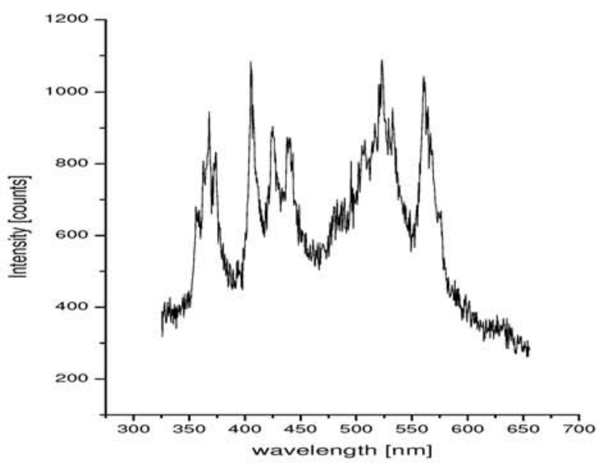

Figure 2. One dimensional profile of lead LIBS signal from Fig. 1.

Identified lead lines [11] are given in Table 1. It is interesting to note that other lines, visible on figures 1. and 2. are not from zinc or copper, as expected. They belong to iron [11]. Namely, it is not uncommon to improve the mechanical properties of lead weights by iron.

Table 1. The most intense spectral lines of Lead in the emission spectrum of laser generated plasma.

λ (nm)	Atom, ion	Transition	E_{high}-E_{low} (eV)
560.885	Pb (II)	$6s^27p(^2P^0_{3/2}) - 6s^27s(^2S_{1/2})$	2.21
520.144	Pb (I)	$6p8s(^1P^0_1) - 6p^2(^1S_0)$	2.387
438.646	Pb (II)	$5s^25f(^2F^0_{5/2}) - 6s^26d(^2D_{3/2})$	2.827
424.492	Pb (II)	$5s^25f(^2F^0_{7/2}) - 6s^26d(^2D_{5/2})$	2.92
405.78	Pb (I)	$6p7s(^3P^0_1) - 6p^2(^3P_2)$	3.056
373.993	Pb (I)	$6p7s(^3P^0_2) - 6p^2(^1D_2)$	3.315
368.346	Pb (I)	$6p7s(^3P^0_0) - 6p^2(^3P_1)$	3.366
363.957	Pb (I)	$6p7s(^3P^0_1) - 6p^2(^3P_1)$	3.407
357.273	Pb (I)	$6p7s(^1P^0_1) - 6p^2(^1D_2)$	3.471

3.CONCLUSION

Preliminary results regarding testing of our LIBS experimental set-up for detecting lead are presented in this paper.

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