LIBS technique based on TEA CO_2 laser for elemental analysis of impurities in graphite

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Introduction

Graphite is very important material in modern technology and there is an interest for rapid and sensitive elemental analysis of its impurities that are usually in the form of the soil aluminosilicate. In this work, applicability of LIBS system based on TEA CO_2 laser with low pulse energy, for elemental analysis of pelleted graphite samples was demonstrated.

Experimental

Spectrochemicaly pure graphite powder was mixed with a powder sample of soil of known composition, and then pelleted under a pressure of 10 tons per cm², for 30 min. The schematic diagram of the experimental arrangement is shown in *Figure 1* .

The plasma was generated by focusing a pulsed TEA CO_2 laser that emits at 10.6 µm on the graphite target at atmospheric pressure.

Optimal condition to obtain best signal to noise ratio for metal elements lines was: laser beam focused 5 mm behind the target and plasma observation zone of 1 mm from the target surface.

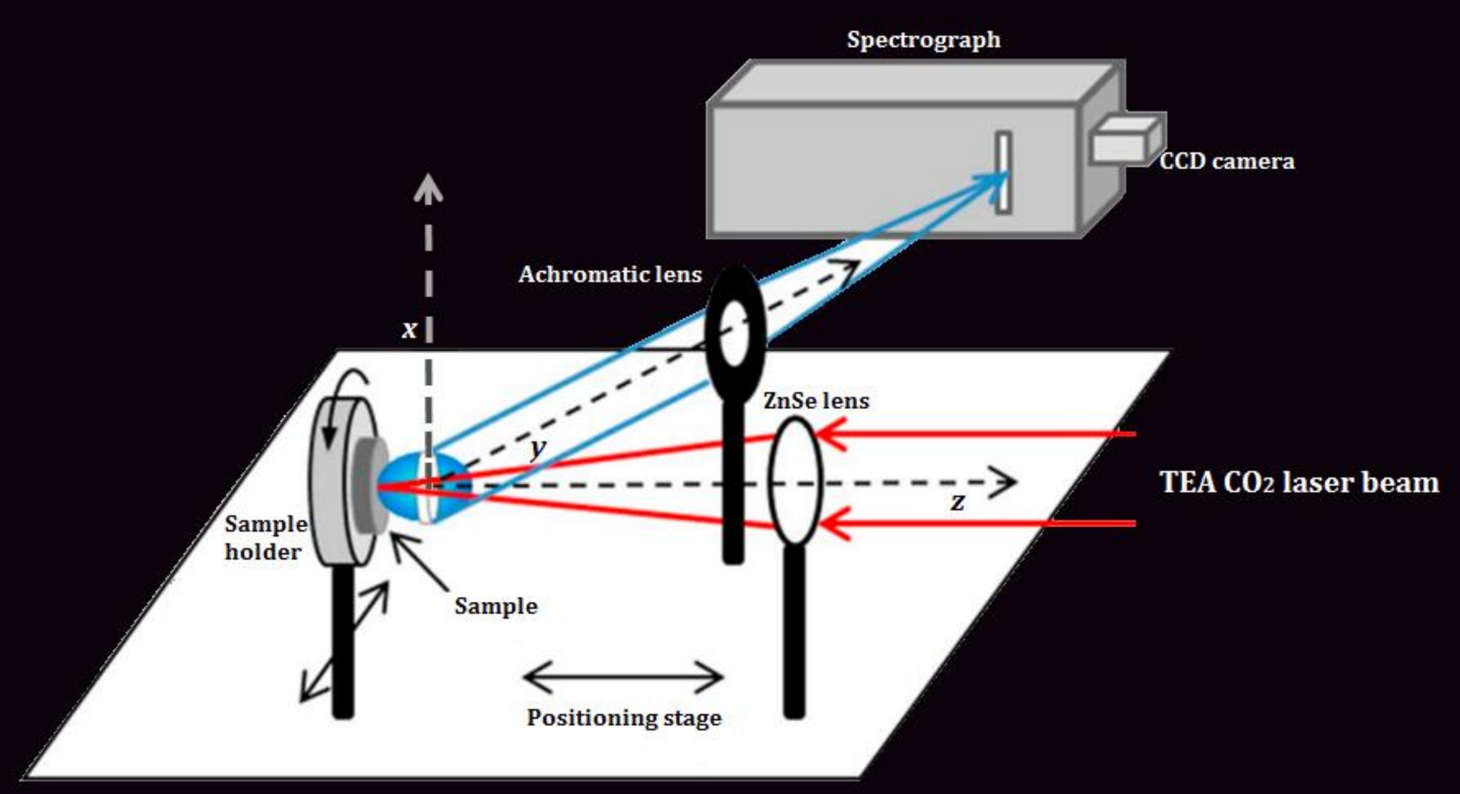

Figure 1 *Schematic diagram of LIBS system.*

Acknowledgments

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References:

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2. Savović, J., Stoiljković, M., Kuzmanović, M., Momčilović, M., Ciganović, J., Ranković, D., Živković, S., Trtica, M. : 2016, Spectrochim. Acta, 118B, 127.

Results

Emission spectra were acquired using LIBS set up. Results are shown in the Table 1 and in *Figure 2* and *Figure 3* .

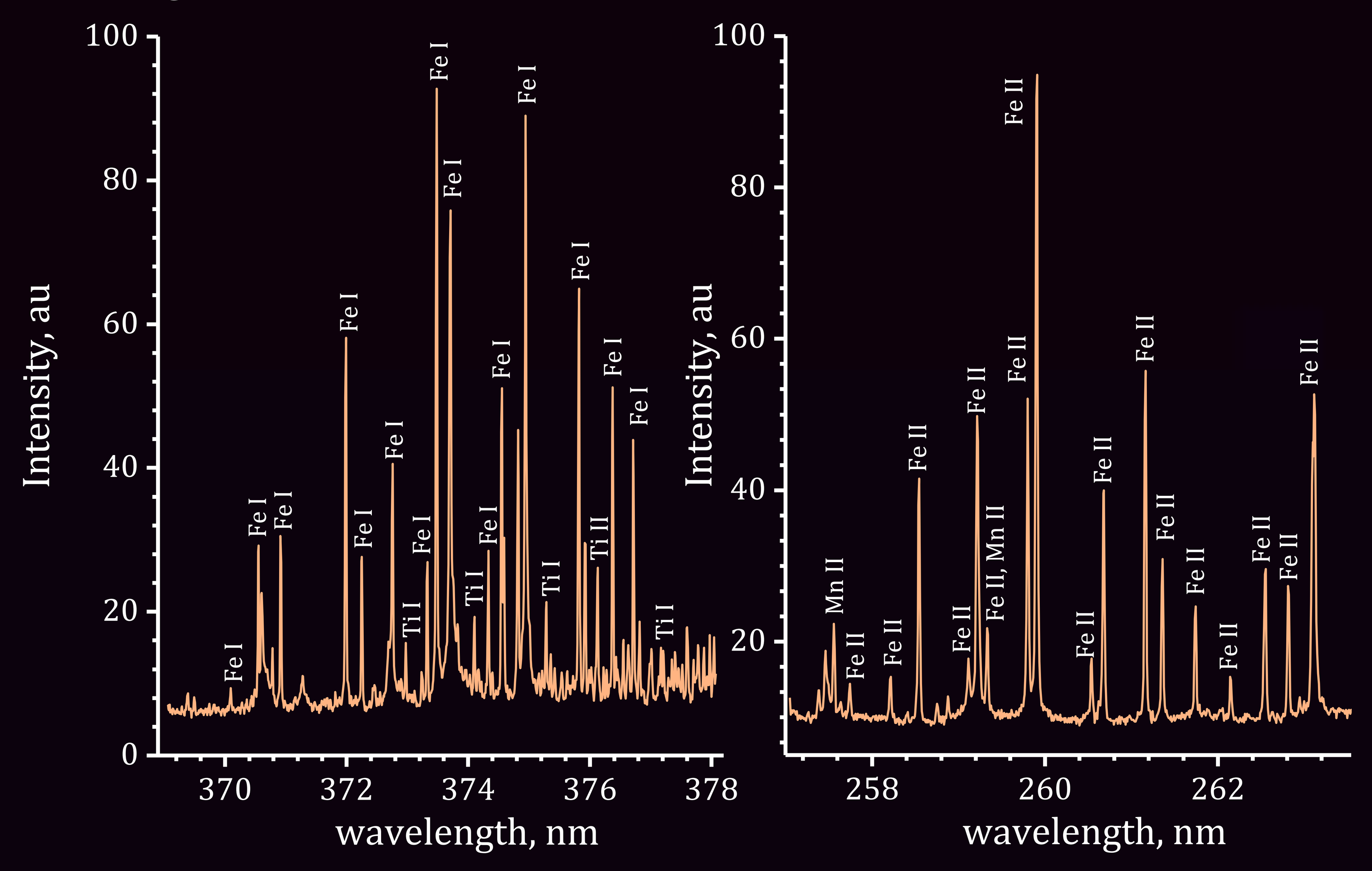

Figure 2 *LIBS spectra of pressed graphite with 5% soil*

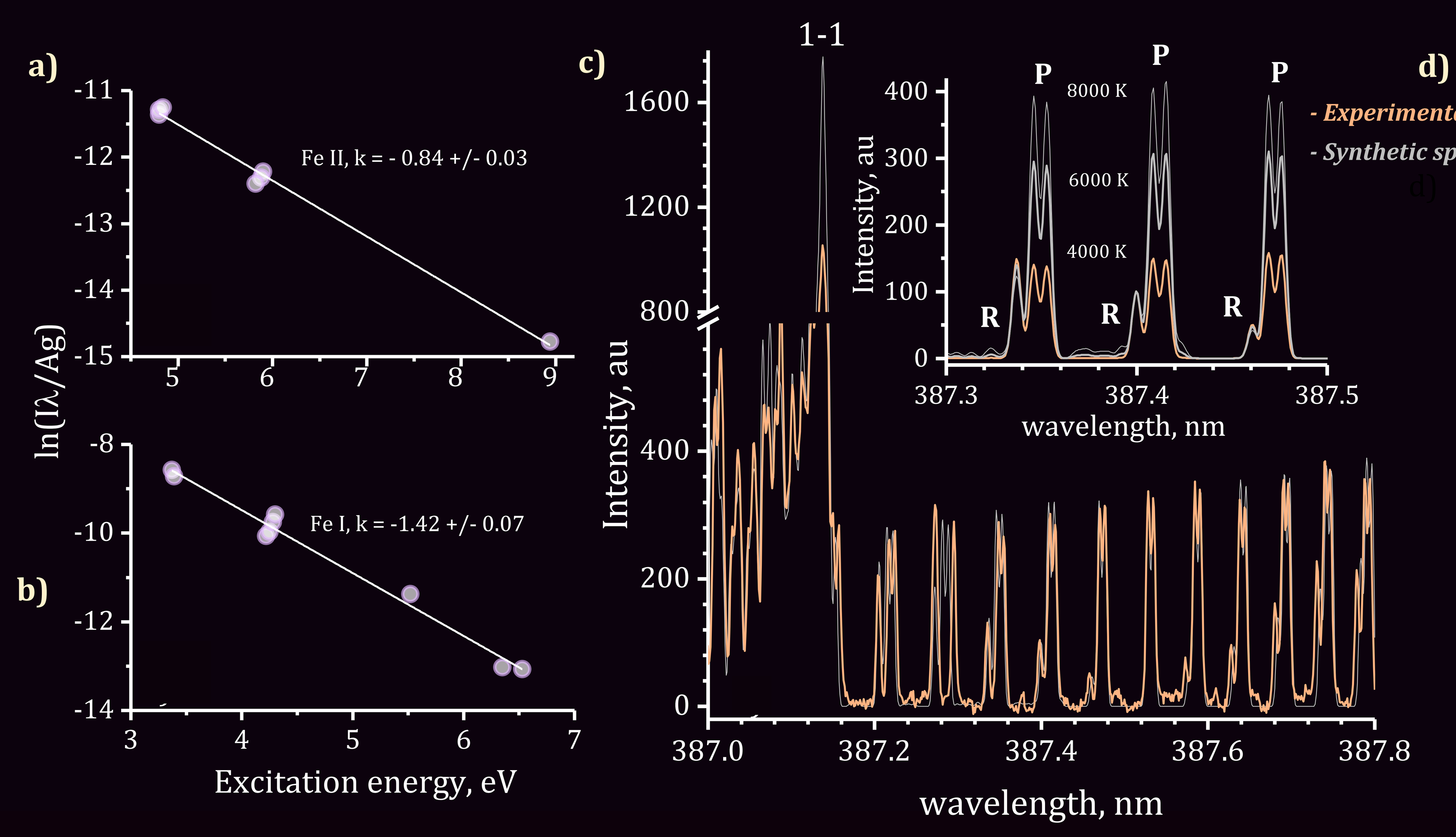

Figure 3 a) and b) Boltzmann plot of ionic and atomic iron lines; c) part of high resolution spectra of 0-0 and 1-1 bands of CN violet system, d) illustrates temperature sensitivity of rotational components of CN band.

Table 1 The obtained LOD values for graphite sample

Graphite sample	Fe II	Fe I	Ti I	Ti II	Mn II	Mg II	S I
LOD, ppm	9.2	67	90	70	10.5	4.5	22

Conclusions

Optical spectroscopy investigation of plasma induced by TEA CO_2 laser on the graphite target was performed to check the applicability of the LIBS technique for elemental chemical analysis of graphite impurities. Low LOD values (10 - 100 ppm) were obtained for metal elements from the soil. Plasma temperatures were estimated using a Boltzmann plot method and by analysing CN emission spectral bands. The obtained temperatures are related to the optimal emission zones of different species: 13800 and 8200 K for ionic and atomic emission of iron, and 6200 K for CN molecular emission.

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