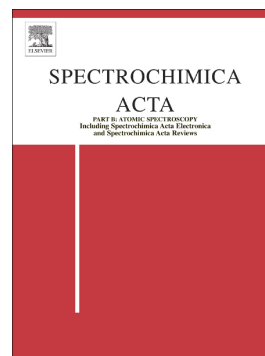


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Stand-off Laser Induced Breakdown Spectroscopy on Meteorites: Calibration-Free Approach

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Abstract

In this work, LIBS (Laser Induced Breakdown Spectroscopy) capability to operate in stand-off configuration, without the need of a direct contact with the sample, has been coupled with the calibration-free (CF) approach to LIBS data analysis. The latter does not require the use of standard calibration. The feasibility of the calibration free method on stand-off LIBS spectra has been thereby tested. The quantitative analysis was performed on samples of two well-known meteorites, Toluca (iron meteorite) and Sahara 98222 (L6 chondrite) by using a stand-off configuration at a distance of 5 meters. The plasma temperature and the electron number densities were determined for each sample and for each laser shot in order to apply the CF method. For the Toluca meteorite sample Fe, Ni and Co content was quantified during the depth profile. For the Sahara 98222 major and minor elements (Fe, Mg, Si, Na, Ti, Al, Cr, Mn, Ca, Ni, Co) were analysed by averaging different meteorite zones because of its strong inhomogeneity. Results demonstrate the possibility of remote analysis of minor bodies and space debris.

Keywords: stand-off LIBS, calibration-free method, meteorites

1. Introduction

In the last decade, several *in-situ* planetary missions have been boosted and performed under the guiding and control of organisms like the National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA) [1, 2]. Together with this extraterrestrial planetary exploration, science community has focused on surveying of on-flight minor bodies, such as anthropogenic space debris, asteroids and meteoroids [3]. In these contexts, the possibility of performing fast and remote analysis of any kind of material is pushing both the development of advanced compact instrument, to be mounted on spacecraft, and flexible analytical methodology to be applied to space exploration and in near earth space survey. Elemental analysis of geochemical

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