4 - 1 A Moveable Laser-induced Breakdown Spectroscopy Instrument for Application

Zhang Dacheng, Ma Xinwen and Zhao Dongmei

As a developing analytical technique, laser-induced breakdown spectroscopy (LIBS) has demonstrated its capabilities for on-line elemental analysis of any material phase without sample preparation or some easy sample preparation. Thus, it has attracted substantial attention nowadays for a wide range of applications. Some LIBS instruments have also appeared in the market over the past few years. However, most prototypes were proposed primarily by research teams mainly in laboratories in connection to potential field applications[1].

This paper presents a moveable LIBS instrument for application developed by ourselves. The picture of the instrument is shown in Fig. 1. A Nd:YAG laseris used for ablation of material and the pulse repetition of laser is 1∼ 20 Hz and its pulse energy can be up to 350 mJ at 1 064 nm with pulse duration of ∼10 ns. The laser beam is focused on the sample using a quartz lens and the plasma emission is collected by a pair of plano-convex quartz lenses to a fible optical spectrometer with a CCD detector. A specially designed location system was used in this instrument which will help users to position the laser focus and the target accurately and to improve the repeatability of measurements. The sample holder is controlled by a 3-D motorized linear stage so that the sample can be refreshed. The spectrometer and the laser are both trigged by a digital delay generator so that the delay time between the laser and the spectra acquisition can be changed easily. A laser guide beam arm is mounted in this instrument and another optical fiber is bundled with it. By switching a mirror for laser propagation, the laser beam can enter the laser guide beam arm and then focused on the target so that the material can be analyzed in site. To enhance user experience, a software based on Labview has been developed which can be used for spectra data acquisition and simple analysis including lines indentification, plasma parameters calculation and so on. We look forward that the instrument can be used for some experimental applications.

Fig. 1 (color online) Picture of the moveable LIBS instrument.

Reference

[1] J. Goujon, A. Giakoumaki, V. Piñon, et al., Spectrochimica Acta Part B, 63(2008)1091.

4 - 2 Investigation of Uranium Spectra by Laser-induced Breakdown Spectroscopy with Ambient Gas

Zhang Dacheng, Ma Xinwen, Zhang Ying, Wang Shulong and Zhu Xiaolong

With the rapid development of nuclear power and nuclear industry, it is needed to develop a novel inspection technology for nuclear materials, nuclear fuel, and nuclear waste, which should provide reliable and fast measurements in various processes of the nuclear fuel cycle. As a purely optical method, laser-induced breakdown spectroscopy (LIBS) is regarded as a suitable method for remote analysis of any material phase in the environment of high radiation levels.

This paper presents the LIBS spectra of uranium metal and their features in different ambient gas at 1atm. The third harmonic pulse of a Nd:YAG laser was used for ablation of uranium metal and the plasma emission was