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Investigation of Laser-Induced Breakdown Spectroscopy combined with Laser-Induced Fluorescence.

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Abstract

Laser-Induced Breakdown Spectroscopy (LIBS) technique combined with a Laser-Induced Fluorescence (LIF) approach is known to be a high sensitivity and high selectivity analytical technique. Although sub-ppm limits of detection (LoD) have already been demonstrated, there is still a constant and urgent need to reach lower LoDs. This improvement can only be achieved by investigating the influence of the numerous experimental parameters. Here, as a proof of concept, we report results obtained for the detection of lead traces in brass samples. The plasma was produced by a Q-switched Nd:YAG laser and then excited selectively by a nanosecond OPO laser. The experiments were performed in air at atmospheric pressure. The excitation wavelength was 283.31 nm while the detected fluorescence wavelength was 405.78 nm. The influence of the ablation fluence, the delay between both ablation and excitation laser pulses and the excitation energy on the LIF signal emitted by lead was studied. A physical interpretation was also provided to support the experimental results. The optimal conditions were obtained for an ablation fluence of about 3 J/cm^2 and an inter-pulse delay of about 5-10 μs. Also, an excitation energy of at least about 60 μJ was required to maximize the LIF signal. Using the LIBS-LIFS technique, a value of 180 ppb was obtained accumulating over 100 laser shots that corresponds to an improvement of about two orders of magnitude with respect to LIBS.