MASTER'S THESIS

Resonance-enhanced laser-induced plasma spectroscopy for elemental analysis

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Resonance-enhanced Laser-induced Plasma Spectroscopy for Elemental Analysis

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Abstract

In the spectrochemical analysis of emissions from laser-induced plasmas, it should be possible to enhance the analyte line emission relative to the continuum background by generating the plasma nonthermally, even for refractory targets. Using pellets of potassium iodate doped with trace amount of sodium (few tens of ppm) as test samples, we demonstrated the resonance-enhancement of the analyte signal. Two sets of experiments were done. In the first set of experiment, the sample was ablated with a single dye laser pulse (404.4 nm) with energy fluence about 100 mJ/cm^2 to 180 mJ/cm^2. Ionization was still thermally induced because the threshold limit of vaporization and atomization of the solid was above the ionization threshold. In the second set of experiments, the sample was first ablated with a Nd:YAG (532 nm) laser pulse with energy fluence about 230 mJ/cm^2, then after about 30 ns, the potassium atoms in the vapor plume were photoionized resonantly by a dye laser pulse (404.4 nm) with energy fluence about 80 mJ/cm^2. The sodium emissions at 589.0 and 589.6 nm were found to be significantly enhanced. The resonance photoionization effect overwhelmed the thermal ionization effect in this double pulse ablation scheme.

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