Halides formation dynamics in nanosecond and femtosecond laser induced breakdown spectroscopy

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LIBS is an analytical technique based on the measurement of the emitted radiation coming from a laser induced plasma created after the irradiation of a sample by a short duration laser pulse ($10^{-15}$-$10^{-9}$ s). This technique is used for the direct determination of the elemental sample composition. However, in the last years there is a rising interest in researching about the molecular presence in laser induced plasmas (LIP). The detection of the molecular emission from LIPs is showing an encouraging way to improve LIBS abilities (i.e. the capability to carry out isotopic analysis [1], the analysis of organic samples by detecting some molecules such as CN, C$_2$ or CH, or sensitivity improvements achieved in halogen analysis by detecting the emission of diatomic molecules containing the halogen [2]). Molecular creation mechanisms, in a typical LIBS plasma, are still very challenging issues under investigation. LIPs are dynamic plasmas with fast time and spatial evolutions. The processes taking place in the plasma, some of them responsible of the molecular formation, are complex; and atoms and molecules can follow different paths in their evolution and distribution. The prevalence of some specific mechanisms in the molecular production, depends on the experimental conditions, and on parameters such as the kind of molecular solids, environment surrounding the sample, laser pulse duration or laser energy.

In this talk different time and spatial resolved experiments carried out in ns- and fs-LIBS to investigate the dynamic of the molecular formation will be shown. The formation of alkaline-earth halide is investigated by using different samples: samples with native bonds between the alkaline-earth and the halogen; samples with the atoms of interest in different compounds, and samples containing the halogen, being the alkaline-earth provided to the surrounds by nebulization [3].