

Femtosecond laser ablation ICP-MS for elemental and isotopic analysis: Are ultrafast lasers worthwhile?

FRANCK POITRASSON, FRANCOIS-XAVIER

D'ABZAC* and JEROME CHMELEFF

Géosciences Environnement Toulouse, CNRS UMR 5563 –
UPS – IRD – CNES, 14-16, av. Edouard Belin, 31400
Toulouse, France.

Laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) is now a method of choice for in-situ elemental and isotopic analysis of solid substrates. However, the limited use of ultra fast femtosecond (fs) lasers is surprising since the technology theoretically eliminates the drawbacks of nanosecond (ns) lasers. Fs-LA is (1) nearly athermal; (2) independent on the optical properties of the target and (3) produces particles of $\sim 0.2\mu\text{m}$, easily ionized in the ICP. The consequent improved ablation yield and reduced chemical fractionation alleviate the need for matrix-matched calibration for analyses of natural complex minerals. We surveyed the fields of trace elements, radiogenic and stable isotopes analysis and evaluated the need for fs-LA over ns-LA. Strategies have been developed to make ns-LA-ICP-MS analyses reliable enough for many applications. Yet, fs-LA is required to study natural variations of stable isotope compositions of less than 0.5‰ or for elemental and isotopic analysis when matrix-matched calibration is not possible.