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Laser-assisted Sampling Techniques in combination with ICP-MS: A novel Approach for Particle Analysis at the IAEA Environmental Samples Laboratory

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Researchers have found many applications for lasers. About two decades ago, scientists started using lasers as sample introduction instruments for mass spectrometry measurements. Similarly, lasers as micro-dissection tools have also been increasingly on demand in the fields of life sciences, materials science, forensics, etc. This presentation deals with the interception of these aforementioned laser-assisted techniques to the field of particle analysis.

Historically, the use of a nanosecond laser to ablate material has been used in materials science. Recently, it has been proven that in the analysis of particulate materials the disadvantages associated with the utilization of nanosecond lasers such as overheating and melting of the sample are suppressed when using femtosecond lasers. Further, due to the length of a single laser shot, fs-LA allows a more controlled ablation to occur and therefore the sample plasma is more homogeneous and less mass-fractionation events are detected.

The use of laser micro-dissection devices enables the physical segmentation of micro-sized artefacts previously performed by a laborious manual procedure. By combining the precision of the laser cutting inherent to the LMD technique together with a particle identification methodology, one can increase the efficiency of single particle isolation. Further, besides the increase in throughput of analyses, this combination enhances the signal-to-noise ratio by removing matrix particles effectively.

Specifically, this contribution describes the use of an Olympus+MMI laser micro-dissection device in improving the sample preparation of environmental swipe samples and the installation of an Applied Spectra J200 fs-LA/LIBS (laser ablation/laser induced-breakdown spectroscopy) system as a sample introduction device to a quadrupole mass spectrometer, the iCap Q from Thermofisher Scientific at the IAEA Environmental Samples Laboratory are explored. Preliminary results of the ongoing efforts for the eventual automation of sample preparation procedures for routine safeguards sample analyses by using the laser micro-dissection technology are discussed.

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