Laser Ablation - Inductively Coupled Plasma - Mass Spectrometry (LA-ICP-MS)

Technology:
Mass Spectrometry of Material Ablated by Laser, Surface and Micro Area Analysis

Equipment:
- *ICP-MS: 7500ce, Agilent*
- *UP 193 FX, New Wave*

Category:
C. Particle Characterisation ex-situ

Institute:
KIT

Location:
Karlsruhe Institute of Technology
Institute for Applied Materials (IAM-AWP)
Building 688
Hermann-v.-Helmholtz-Platz 1
D-76344 Eggenstein-Leopoldshafen
Germany

Contact Details of Technology Expert:
Name: Dr. Thomas Bergfeldt
Phone: +49 721 608-22914
Fax: +49 721 608-922914
E-mail: Thomas.Bergfeldt@kit.edu

Short technology description/Overview and Main Features (Equipment Capabilities)::

LA-ICP-MS is a sensitive analytical method (0,000001 – 100%) for rapid multi-element (Li - U except C, N, O, F, Cl) determination in the trace and ultra trace range of different solid sample materials, technical products and even biological samples (biological samples can't be analyzed in this laboratory). A small area (Ø 10 – 200 µm) of the sample is vaporized in a laser plasma by focused laser radiation and transported with helium in the inductively coupled plasma ion source of an ICP-MS. There the material is atomized, ionized, accelerated into the mass spectrometer and separated according the mass/charge ratio and energy/charge ratio and detected by electron multipliers.
The main advantage of LA-ICP-MS is that samples are investigated not under vacuum but in atmospheric pressure and electrically conducting as well as non-conducting material can be investigated.

Typical Samples & results:

Quantitative analysis of small metal fragments by LA-ICP-MS. Instrument calibration was achieved using 8 flat geometry steel setting-up samples (BAS UK). The samples included low-alloy and highly-alloyed steels. The elements varied from ppm to high % levels.

	Al		P		V		Cr		Nb		Mo		Sn	
	Cert	LA	Cert	LA	Cert	LA	Cert	LA	Cert	LA	Cert	LA	Cert	LA
A/8	.04	.04	.005	.01	.005	.001	.02	.03	.01	---	.005	.002	.005	.001
D/11	.19	.19	.01	.02	.12	.11	3.0	3.1	.05	.05	1.3	1.3	.01	.01
C/17	.05	.05	.07	.08	.42	.42	.18	.20	.02	.03	.11	.11	.06	.07
H/5	.2	.16	.04	.06	.33	.33	1.3	1.1	.11	.09	.42	.45	.03	.03
G/5	.005	.006	.03	.04	.06	.07	16.5	12.9	.005	.003	2.2	2.2	.01	.02
E/4	.03	.04	.01	.02	.03	.04	4.3	3.6	1.1	1.2	.97	.98	---	.002
B/6	.01	.02	.005	.01	.01	.01	1.2	1.2	.005	.006	.20	.21	.01	.01
F/4	.005	.004	.02	.03	.05	.05	25.5	23.4	.005	.001	3.5	3.4	.01	.02

Table 1: Comparison of LA-ICP-MS values with certified values (bulk samples). All data % (w/w)

Acknowledgements to Dr. Walter Grillo and Dr. Massimo Godano, FIAT, Turin, Italy

Any further Information: