

JAAS

Journal of Analytical Atomic Spectrometry

rsc.li/jaas

The Royal Society of Chemistry is the world's leading chemistry community. Through our high impact journals and publications we connect the world with the chemical sciences and invest the profits back into the chemistry community.

IN THIS ISSUE

ISSN 0267-9477 CODEN JASPE2 41(1) 1–536 (2026)



Cover

See Xu Tang, Jinhua Li *et al.*, pp. 88–100. Image reproduced by permission of Xu Tang from *J. Anal. At. Spectrom.*, 2026, 41, 88.



Inside cover

See Cassiana Seimi Nomura *et al.*, pp. 101–111. Image reproduced by permission of João Manoel de Lima Júnior from *J. Anal. At. Spectrom.*, 2026, 41, 101. The background was generated from a real image using Gemini AI.

ATOMIC SPECTROMETRY UPDATES

16

Atomic spectrometry update: review of advances in environmental analysis

Warren R. L. Cairns,* Emma C. Braysher, Owen T. Butler, Olga Cavoura, Christine M. Davidson, Jose Luis Todoli Torro and Marcus von der Au



Atomic
Spectrometry
Updates

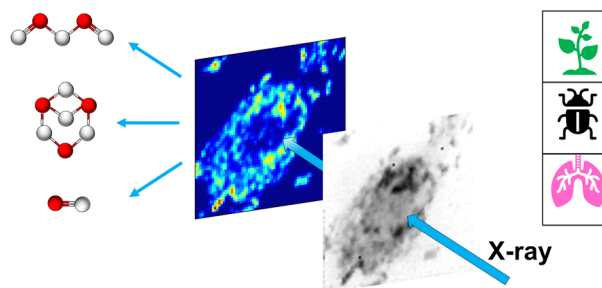


COMMUNICATION

71

Recent advances in micro-XANES application in biology at the TwinMic beamline

Valentina Bonanni,* Francesco Guzzi, Milan Žižić, George Kourousias and Alessandra Gianoncelli



**GOLD
OPEN
ACCESS**

EES Solar

**Exceptional research on solar
energy and photovoltaics**

Part of the EES family

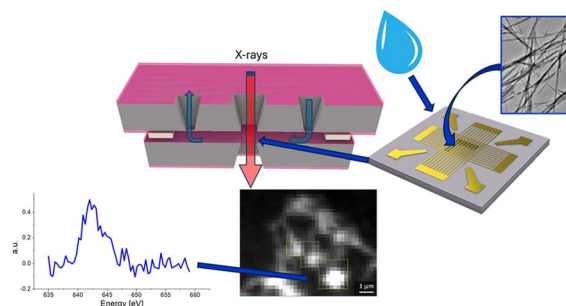
**Join
in** | Publish with us
rsc.li/EESolar

TECHNICAL NOTE

78

Electrochemical wet-cell fabrication for *in situ* soft X-ray hyperspectral imaging of real-life ORR electrocatalysts

Benedetto Bozzini,* Alessandro Alleva, Maria Eugenia Fortes Brollo, Regina Ciancio, Simone Dal Zilio, George Kourousias, Francesco Nespoli, Paolo Ronchese and Alessandra Gianoncelli

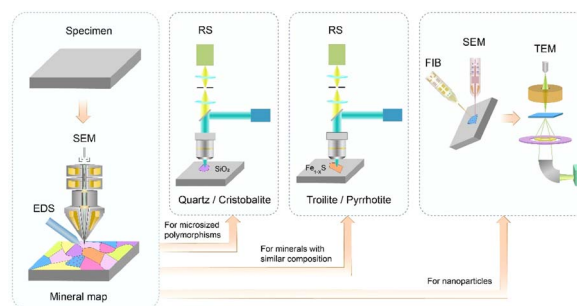


PAPERS

88

Optimized multi-microbeam analytical techniques for rapid and accurate identification of lunar minerals: insights from Chang'e-5 basaltic clasts

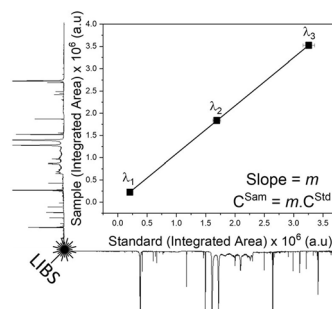
Xu Tang,* Lixin Gu, Di Zhang, Xiaoguang Li, Lihui Jia, Li Wang, Hengci Tian, Shuhui Cai, Wei Yang, Qiuli Li and Jinhua Li*



101

Partial matrix matching multi-energy calibration for direct quantification of Al, Fe, Li and Si in spodumene by laser-induced breakdown spectroscopy

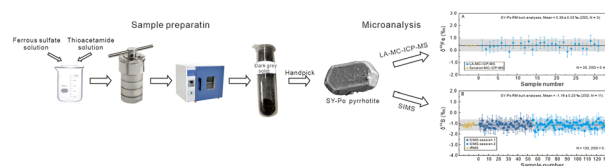
João Manoel de Lima Júnior, Nicolas Pico de Azeredo, Juliana Naozuka, Carina Ulsen, George L. Donati and Cassiana Seimi Nomura*



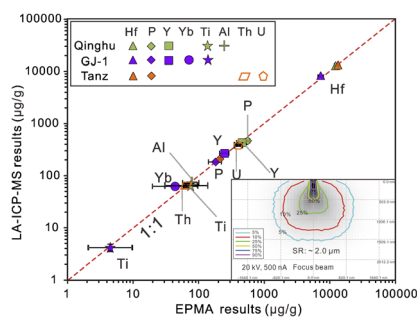
112

A new potential synthetic pyrrhotite reference material for Fe–S isotope microanalysis

Xiao-Yan Liu, Lei Chen,* Fu-De Zhao, Fei Huang, Qiu-Li Li, Hui-Min Yu and Xian-Hua Li



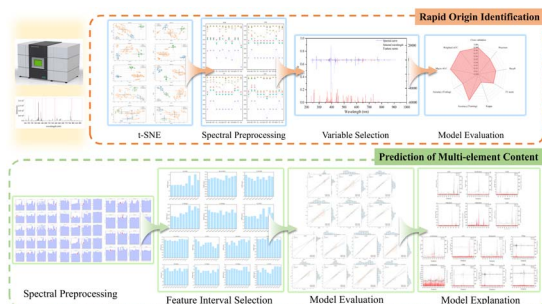
121



High-accuracy analyses of key minor and trace elements in zircon by electron probe microanalysis

Lihui Jia,* Yi Chen, Yu Li, Qian Mao, Hao Wang, Zeling Wang and Haojie Chen

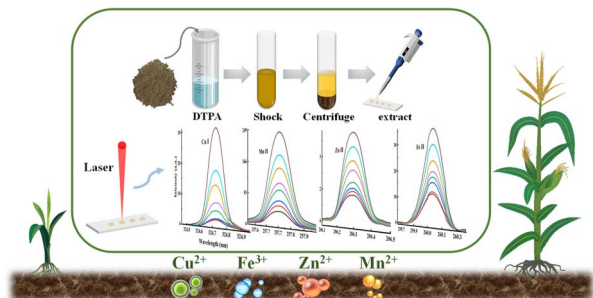
135



Rapid origin traceability and multi-element quantification of *Hypericum perforatum* L. using LIBS combined with machine learning methods

Zhiyong Zhang, Wennan Nie, Guangpu Fang, Jiahe Qian, Hongxia Gan, Jingchao Chen and Wenlong Li*

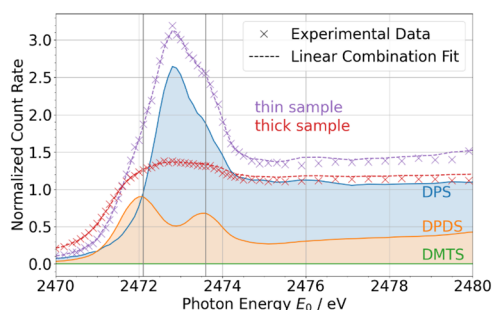
147



The rapid detection of bioavailable micronutrients Cu/Fe/Zn/Mn in soil using laser-induced breakdown spectroscopy combined with solid-liquid-solid transformation

Yangrui Li, Zhizheng Shi, Leizi Jiao, Ning Liu, Zhen Xing, Shixiang Ma, Hongwu Tian* and Daming Dong*

155



Quantification of the sulfur strand length distribution in organo-sulfur cathode materials with X-ray absorption spectrometry

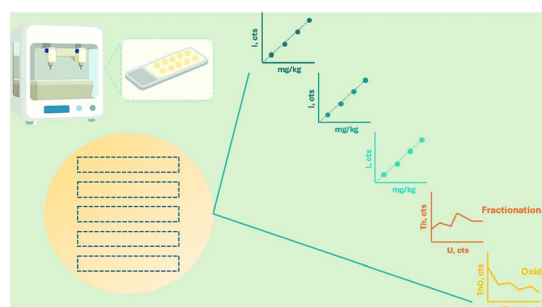
Konstantin Skudler,* Rukiya Matsidik, Hongfei Yang, Michael Walter, Michael Sommer and Matthias Müller*



164

Towards improved workflows for the production and metrological characterization of LA-ICP-MS calibration standards for quantitative bioimaging

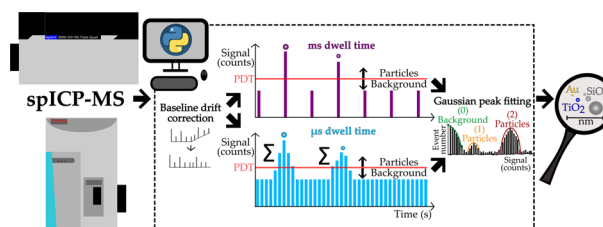
Kharmen Billimoria, Paula Menero-Valdes,* William Lee, Alex Shard and Heidi Goenaga Infante



173

Improved single particle ICP-MS assessment using a novel Python-based data processing algorithm (Sparta) for nanoparticle quantification

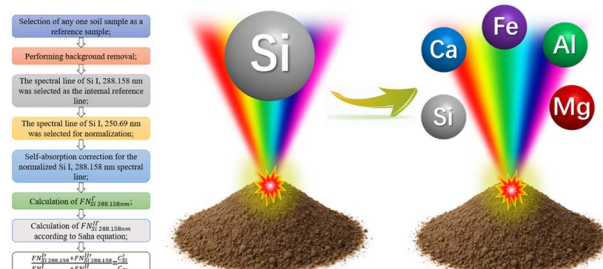
Steffen Hellmann,* Teba Gil-Díaz, Mario Corte-Rodríguez, Dirk Merten, María Montes-Bayón and Thorsten Schäfer*



190

Multi-element determination in soil using laser-induced breakdown spectroscopy with only one internal reference element by one-point calibration

Nan Zhao, Zeren Luo, Bin Wang, Ruitao Lin, Shaofeng Zheng, Shixiang Ma, Kuohu Li,* Erlong Jiang, Jiaming Li* and Qingmao Zhang



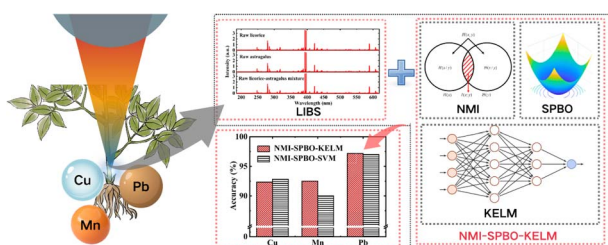
199

Hidra aeschynite-(Y): a potential natural reference material for microbeam Pb–Pb and Lu–Hf geochronology

Bo Yang, Xiao-Xiao Ling, Yu Liu, Zhao-Xue Wang, Zhu-Yin Chu, Shi-Tou Wu,* Hao Wang, Yue-Heng Yang and Xian-Hua Li



211

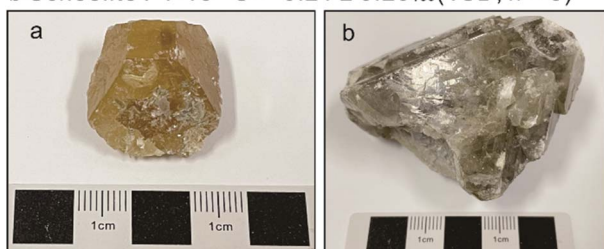


Highly accurate classification of herbals relying on toxic elements via laser-induced breakdown spectroscopy and chemometrics

Chenwei Zhu,* Qizhong Pan, Zhanjian Lin and Xiangyou Li

218

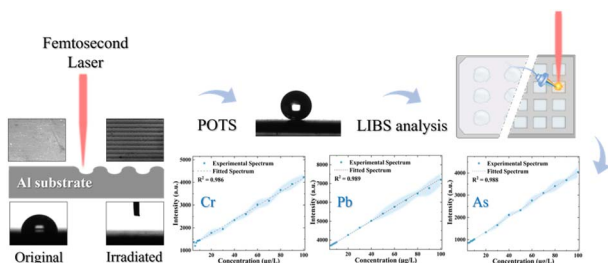
a Scheelite XBD- $1\delta^{18}\text{O}=8.57 \pm 0.20\text{‰}$ (1SD, $n = 2$)
 b Scheelite PT- $1\delta^{18}\text{O}=-6.21 \pm 0.20\text{‰}$ (1SD, $n = 3$)



XBD-1 and PT-1 scheelites: potential reference materials for SIMS oxygen isotope analysis

Jiao Li, Aleksei Melnik, Xiao-Xiao Ling, Yu Liu, Guo-Qiang Tang, Qiu-Li Li,* Feng-Tai Tong, Ming-Chao Li, Yong-Bo Peng, Hong-Xia Ma and Xian-Hua Li

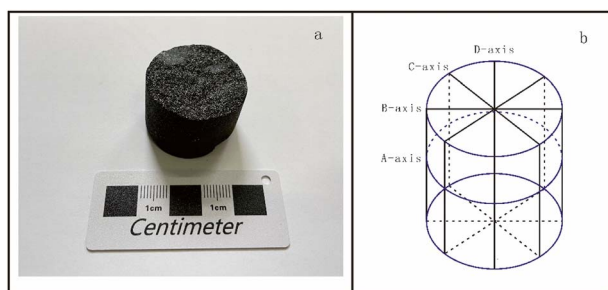
223



Enhanced toxic trace element detection in water using LIBS combined with a femtosecond laser-engineered hydrophobic-hydrophilic structured substrate

Gangrong Fu, Rubo Chen, Yue Li, Jie Wu, Shutong Wang, Guoliang Deng,* Hao Zhou,* Hong Zhao and Shouhuan Zhou

231



Natural chromite as a reference material for LA-ICP-MS analyses: development and calibration

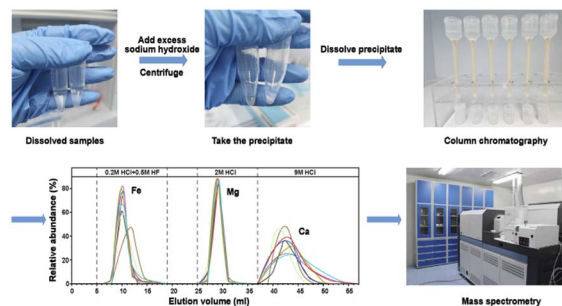
Dan Chen, Zhihui Dai,* Liemeng Chen, Zhenhui Hou, Dengfeng Li and Tingguang Lan



242

A rapid method for separating magnesium, iron and calcium from low-Mg rocks for precise measurement via MC-ICP-MS

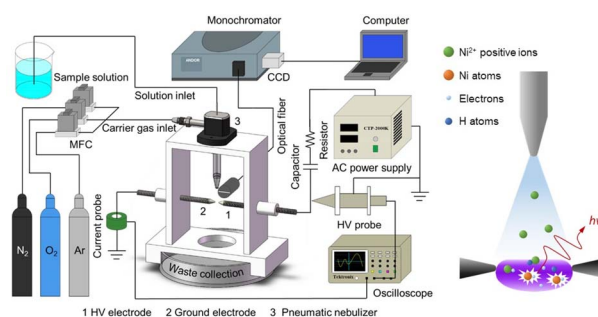
Zhao-Ya Li, Xing-Hao Zhang, Guo-Chao Sun,*
Hai-Ou Gu, Qiong-Xia Xia,* Li-Qun Dai, Jin-Jing Huo
and Zi-Fu Zhao



252

AC needle-to-needle bare electrode discharge with nebulized sample injection for elemental analysis

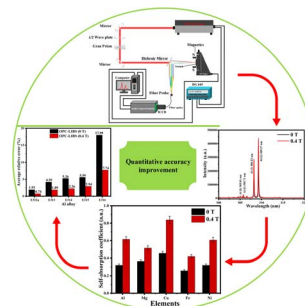
Hao Yuan, Shu-Qi Li, Jian-Ping Liang,* Zhao-Lun Cui,
De-Zheng Yang* and Rajdeep Singh Rawat



261

Improving the quantitative accuracy of one-point calibration LIBS based on magnetic confinement of self-absorption correction

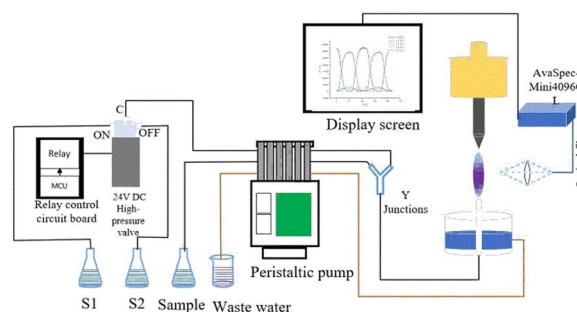
Rana Muhammad Shahbaz, Qiuyun Wang, Hailong Yu,*
Yinping Dou, Xun Gao* and Jingquan Lin



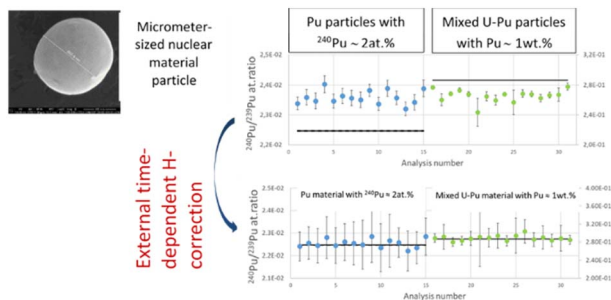
271

Solution cathode glow discharge-atomic emission spectrometry using automated standard dilution analysis for the determination of Ca, Fe, and Zn in glucose oral solution

Biyong Zhang, Peichao Zheng,* Jinmei Wang,*
Xuanyu Luo, Jialong Li, Junhao Xiang, Lianbo Guo,
Hongwu Tian and Daming Dong



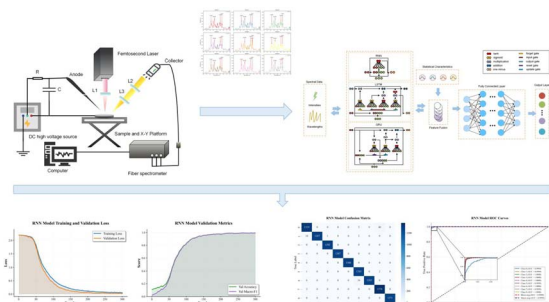
282



Time-dependent hydride correction for accurate $^{240}\text{Pu}/^{239}\text{Pu}$ isotopic ratio measurements in μm -sized Pu-bearing particles using large geometry-secondary ion mass spectrometry

Anne-Laure Fauré* and Manon Cornaton

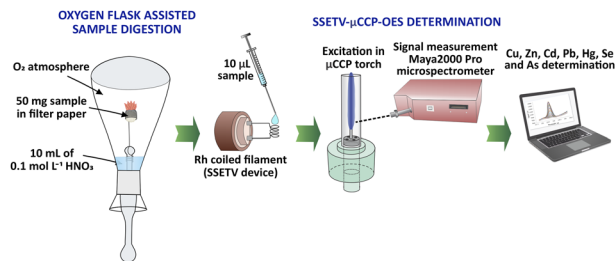
294



Deep recurrent neural networks with spectral-statistical fusion for industrial-grade steel alloy classification using femtosecond laser-ablation spark-induced breakdown spectroscopy

Kaiqiang Que, Xiaoyong He,* Tingrui Liang, Zhenman Gao and Xi Wu*

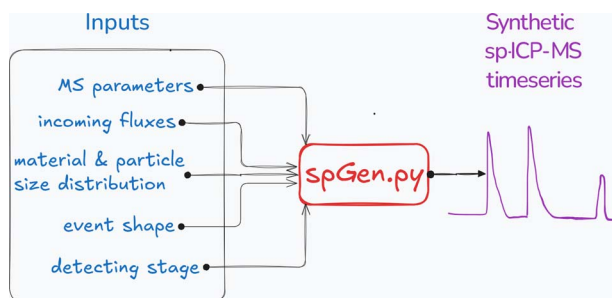
308



Cost-effective oxygen flask combustion and electrothermal vaporization capacitively coupled plasma microtorch optical emission spectrometry as a green and white method for multielemental determination in food

Augustin Catalin Mot, Adrian-Ioan Dudu, Tiberiu Frentiu, Dorin Petreus, Erika-Andrea Levei, Zamfira Stupar, Maria Frentiu and Eniko Covaci*

320



Synthetic generation of single-channel single particle ICP-MS time scans

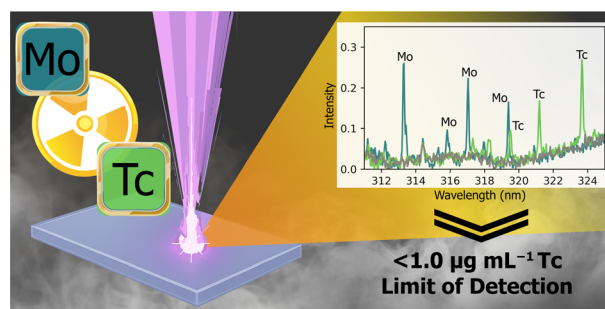
Pierre-Emmanuel Peyneau,* Léonard Seydoux and Mickaël Tharaud



333

Detection and quantification of trace technetium in the presence of molybdenum using laser-induced breakdown spectroscopy

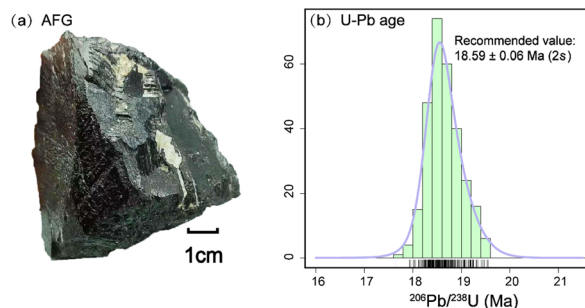
Hunter B. Andrews,* Zachary Murphy, Mauro Martinez, John Lucchi, Vasileios Anagnostopoulos and Matthieu Baudelet*



340

AFG – a new Cenozoic columbite–tantalite natural reference material for LA-ICP-MS U–Pb geochronology

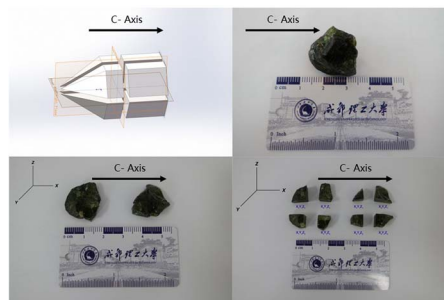
Liyuan Qing, Tao Luo,* Jiarun Tu, Wen Zhang, Hongtao Shen, Xiaodong Deng and Zhaochu Hu



351

OLG: a new potential reference material for apatite (U–Th)/He dating

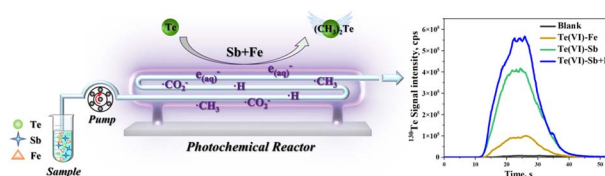
Jie Hu, Yuntao Tian, Xiaoming Shen, Zhiwu Li,* Qiqi Song and Chenghao Wei



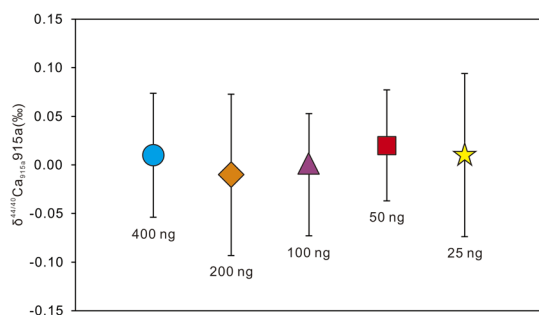
363

Highly efficient photochemical vapor generation of tellurium: effects of antimony and ferric ions

Weiwen Huang, Ying Yu, Liang Dong, Xiuqin Deng, Xinyi Zhao, Liwei Liu* and Ying Gao*



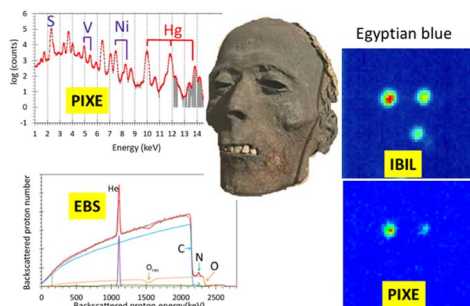
372



A high-sensitivity loading method using tantalum (Ta) gel for high-precision Ca isotope measurement by TIMS

Xiong Yang, Shixin Gao, Da Wang,* Xin Li, Fang Liu, Wenke Wang, Zhengjie Zhao and Zhaofeng Zhang

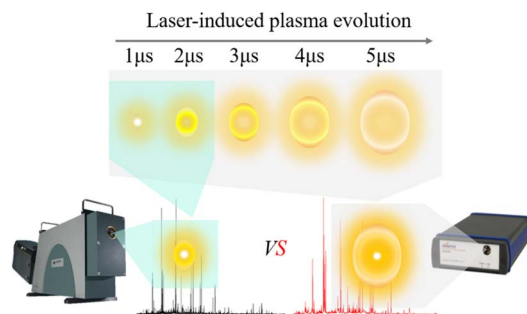
385



Tracing the *post-mortem* history of Egyptian mummies using nuclear microprobe analysis of trace metal elements and mineral dust particles

Didier Gourier,* Océane Anduze, Quentin Lemasson, Laurent Pichon, Thomas Calligaro, Agnès Lattuati-Derieux and Laurent Binet

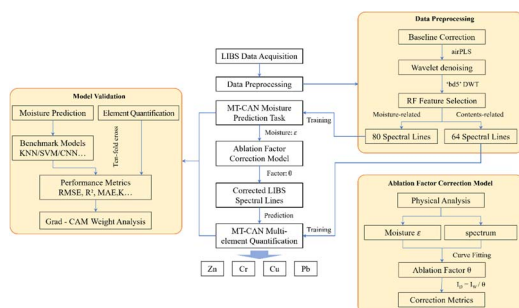
404



Investigating the impact and mechanisms of integration time on LIBS repeatability and plasma parameter inversion results

Chao Li, Yunfeng Bi,* Zhongyi Bao, Tao Zhang, Caijie Liu, Meili Guo and Man Wang

416



In situ multi-element soil analysis using laser-induced breakdown spectroscopy (LIBS)

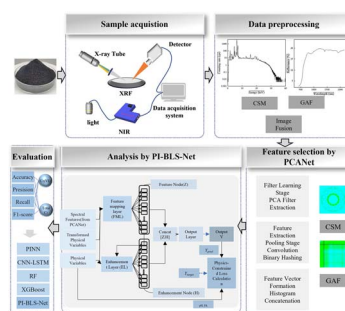
Minghui Gu, Huansong Huang, Qingbin Jiao,* Ding Ma, Yuxing Xu, Chao Liu, Jiguo Li, Xin Zhang, Mingyu Yang, Liang Xu, Sijia Jiang, Hong Li, Jiahui Qi, Junbo Zang and Xin Tan*



426

Combining a physics-informed broad learning system and multimodal spectral fusion for accurate analysis of chromium speciation in tailings

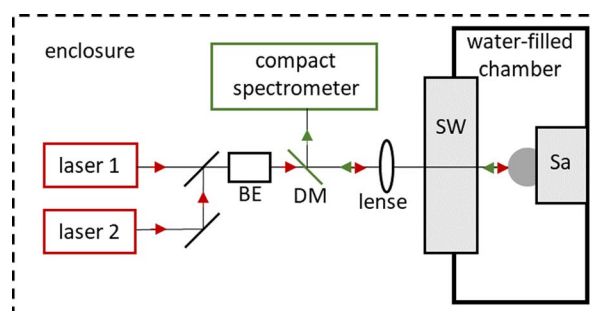
Qingya Wang, Shubin Lyu, Haoyu Zou and Fusheng Li*



438

Determination of elemental concentrations in underwater LIBS plasmas using spectral simulation for copper–zinc alloys

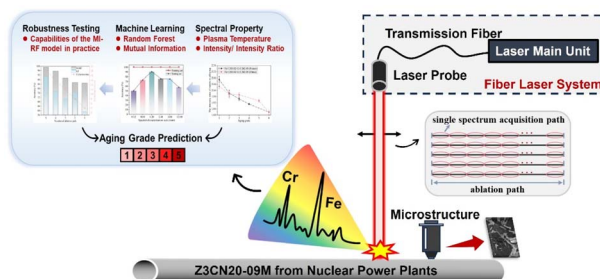
Marion Henkel,* Michelle Siemens, Benjamin Emde, Jörg Hermsdorf and Diego Gonzalez



448

Aging grade estimation of Z3CN20-09M steel from nuclear power plants using LIBS based on fiber laser ablation combined with mutual information-random forest

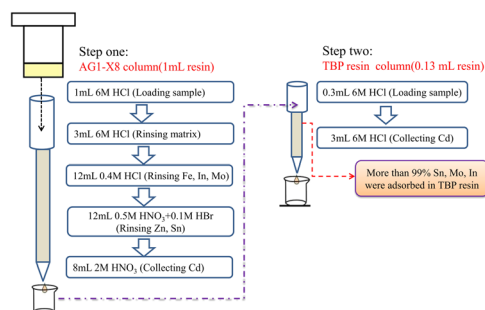
Qi Yang, Jinna Mei,* Sijie Feng, Yuhua Hang, Weizhe Ma, Chengjun Li, Huaiqing Qin, Fangjie Shi, Zhimin Lu, Chao Ye and Shunchun Yao*



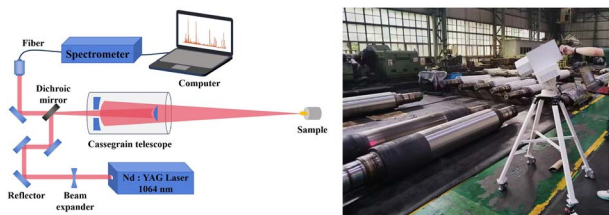
460

Purification scheme with AG1-X8 and TBP resins for Cd isotopic composition determination by double-spike thermal ionization mass spectrometry

Chao-Feng Li,* Zhu-Yin Chu and Peng Peng



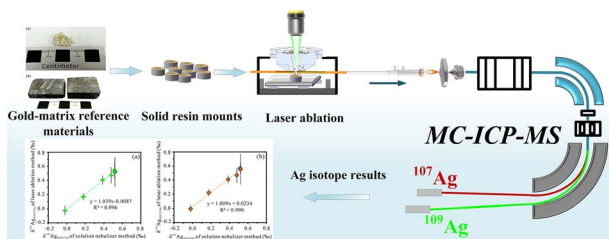
469



A multi-distance shared calibration curve for quantitative analysis of manganese in high-manganese steel based on a portable remote LIBS instrument

Yue Tang, Haodong Wu, Kaiming Sha, Zixin Zhang, Mengjiao Zhu, Linjie Luo, Adil Shahbaz, Guanghui Niu, Qingyu Lin* and Yixiang Duan

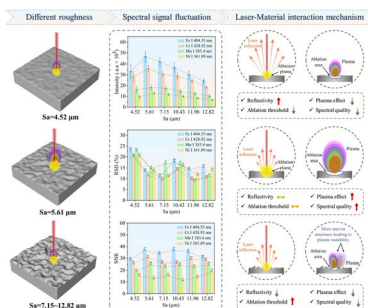
477



Development of gold reference materials for *in situ* Ag isotopic analysis

Zhian Bao, Deyi Peng, Peng Liu,* Yongfei Tian, Chunlei Zong and Honglin Yuan

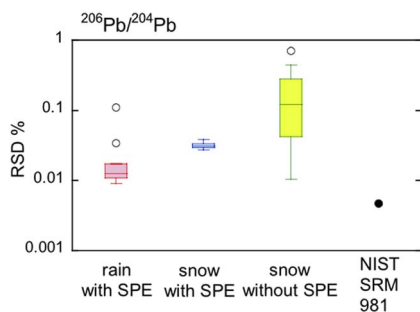
486



Laser-induced breakdown spectroscopy (LIBS) of LPBF-fabricated alloy steel: effect of surface roughness and the laser–material interaction mechanism

Tian Huang, Xinzhou Zhang, Liwen Cao, Tao Zhu, Changqiu Chen, Qian Liu, Jing Zhao, Shuke Huang, Ming Huang, Xianfeng Shen* and Zhihui Xia*

497



High precision Pb isotope ratio analysis of wet depositions with low Pb concentration using multi-collector type inductively coupled plasma mass spectrometry and solid phase extraction

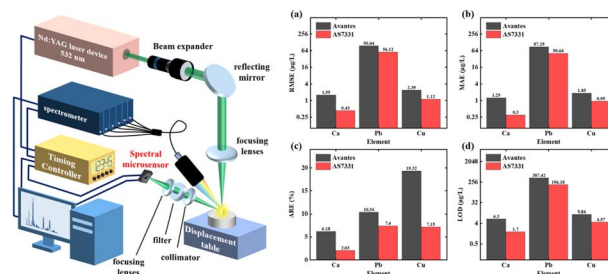
Yuhei Yamamoto,* Shun-ichi Tokoro, Ryoich Nakada, Kazuya Nagaishi, Yoichi Kikuchi, Jun Nishimoto and Shoji Imai



505

A spectral microsensor applied in LIBS for heavy metal detection in water

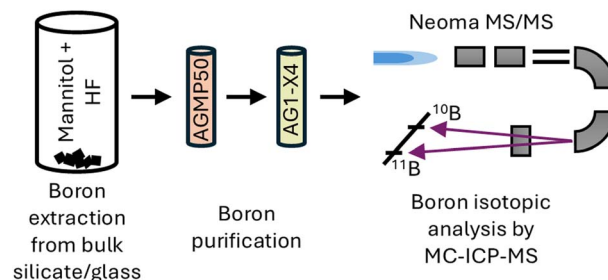
Zixiao Wang, Honghua Ma, Weihua Huang, Lianbo Guo* and Wen Cheng*



513

Boron isotopic analysis in bulk silicate materials using the Neoma MS/MS MC-ICP-MS

Sean R. Scott,* Matthew A. Coble, Natalie E. Sievers, Kirby P. Hobbs, Tyler D. Schlieder and Mindy M. Zimmer



526

Combined effect of borohydride hydrolysis and chemical additives on lead determination by CVG in the presence of transition metals

Massimo Onor, Beatrice Campanella,* Emanuela Pitzalis and Alessandro D'Ulivo

