Rapid classification of heavy metal soils from different mining areas by GSCV quadratic merit seeking network combined with MF-LIBS

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1. Reference links to related instruments

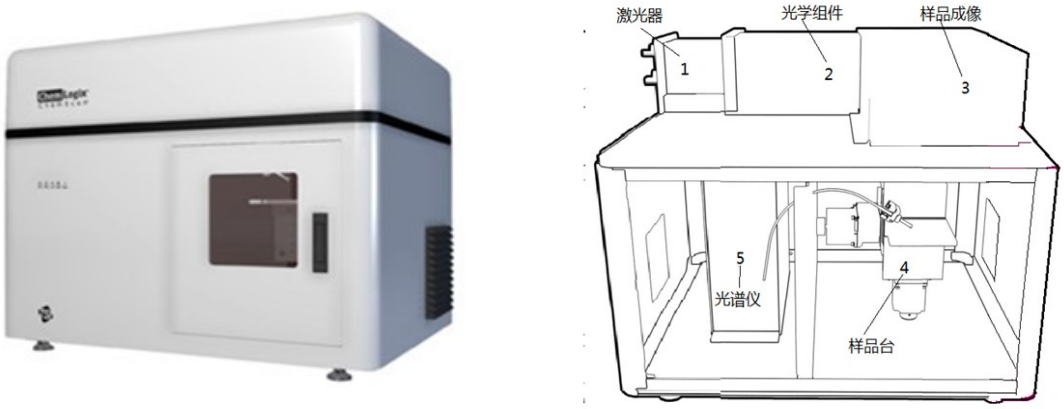


Fig.1 ChemReveal benchtop laser-induced breakdown spectrometers

The basic parameters of TSI laser induced breakdown spectrometer are as follows :

- Element range : atomic number Z ≥ 1 (including C, H, O, N, Li, Be, B, etc.);
- Concentration range : 10 ppm ;
- Analysis time : generally about 20 s ;
- Sample preparation : solid or pressed into flake powder ;
- Sample placement and positioning : the XYZ axis can be freely transformed, and the stroke can reach 5 cm ;
- Micron level (< 1 um) high precision positioning control ;
- Minimum sample mass : 100 pg to 10 mg, depending on the sample ;
- The maximum sample size is about 12.7 cm × 22.8 cm × 12.7 cm;
- Analysis of spot size : minimum : 10 um, maximum : 500 um ;

- Analysis depth : 1 um-100 um, depending on the material and laser energy.

Instrument related URL link:
https://www.hi1718.com/product/2014819175053780.html

Fig. 2 Quantel CFR 200 pulsed Nd:YAG laser

In this paper, the laser in LIBS detection equipment is a Nd : YAG laser from Quantel, France. Its appearance is shown in Fig.2.The maximum frequency is 10 Hz, the maximum pulse energy is 200 mJ, the wavelength is 1064 nm, and the pulse duration is 10 ns.

Fig. 3 Seven-channel wide-width spectrometer

In the LIBS system device, in addition to the laser, the spectrometer is also an indispensable device in the LIBS device. The spectrum detected by the spectrometer in LIBS requires a large spectral coverage to meet its detection requirements. In addition, the minimum resolution of the spectrometer cannot be less than 1 nm.

In this paper, the spectrometer in LIBS detection equipment is a seven-channel wide-width spectrometer of Avantes company in the Netherlands. The spectral range

is 190 nm-950 nm, and the spectral resolution is 0.1 nm. The external device can be triggered by an external TTL level or output level.

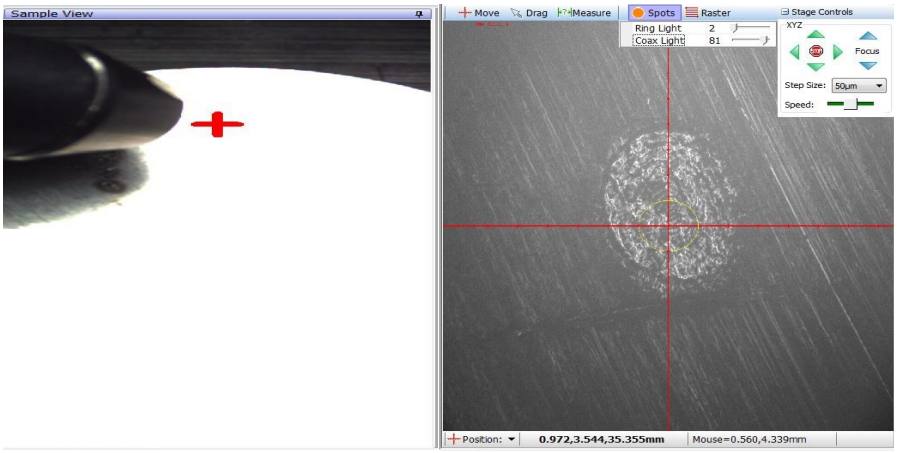


Fig.4 ChemLogix software sample observation window

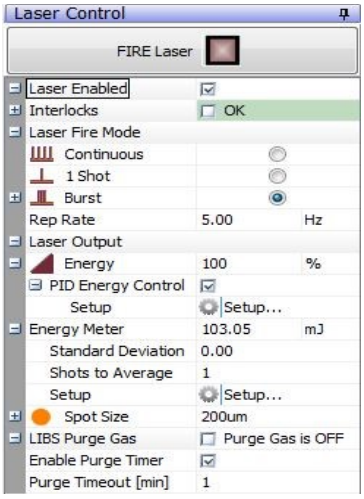


Fig. 5 ChemLogix software parameter setting interface

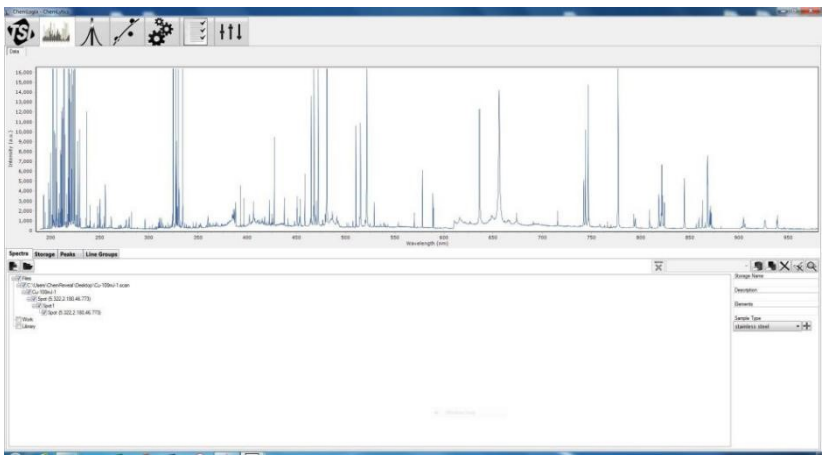


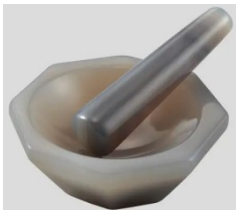
Fig. 6 ChemLytics software interface

ChemLytics software is the spectral analysis software of LIBS system. The software contains the periodic table of elements, which can determine the types of elements in the sample to be measured in real time. In addition, the spectral data can be converted into excel files for subsequent spectral analysis.

(a) Roll crushing mill

(b) Sealed grooved divider

(c) Tablet press



(d) agate mortar

(e) drying machine

Fig. 7 Sample preparation equipment

Instrument related URL link:

(a) https://b2b.baidu.com/land?id=7e70e0c2add19ac03cca7f359a2bbcf310

(b) https://www.ehsy.com/product-CUU899

(c) https://www.instrument.com.cn/netshow/C395050.htm

(d)https://detail.1688.com/offer/546435452253.html?spm=a261b.2187601.com-list.8.25752b07oMCjG3

(e) http://www.jnlbyl.cn/specialsubject/ganzaoxianghz/lsgzx.html?SaleId=2353