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Laser-induced breakdown spectroscopy

激光诱导击穿光谱法

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Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009. Please note

that some elements of this document may involve patents. The issuer of this document is not responsible for identifying these patents. This standard is proposed by the Chinese Academy of Sciences. This standard is under the jurisdiction of the National Technical Committee for Photoelectric Measurement Standardization (SAC/TC487). This standard was drafted. Institute of Optoelectronics, Chinese Academy of Sciences, Beijing Guoke Century Laser Technology Co., Ltd., Shanghai Jiaotong University, Steel Research and Development Keysight Technology Co., Ltd., Beijing Institute of Technology, Tsinghua University, Dalian University of Technology, Ocean University of China, Huazhong University of Science and Technology, Sichuan University, Shanxi University, Northwest Normal University, Beijing Physical and Chemical Analysis and Testing Center, South China University of Technology, Anhui University, Chinese Academy of Sciences Xi'an Guang Institute of Precision Machinery, Beijing University of Chemical Technology, Changchun University of Technology, Northwest University, Nanjing Advanced Laser Technology Research Institute, Shandong Dongyi Optoelectronics Instrument Co., Ltd., Shandong Huatang Environmental Protection Technology Co., Ltd., Hebei Iron and Steel Group Research Institute of Iron and Steel Technology. The main drafters of this standard. Zhao Tianzhuo, Fan Zhongwei, Xiao Hong, Lu Yonghong, Yu Jin, Jia Yunhai, Wang Qianqian, Ding Hongbin, Wang Zhe, Ma Xiaohong, Li Xiangyou, Li Ying, Sun Duoxi, Dong Chenzhong, Zheng Ronger, Lu Jidong, Lin Xiaomei, Duan Yixiang, Li Hua, Pan Congyuan, Wang Yu, Zhang Yong, Zhang Lei, Liu Jia, Chen Guofei, Yao Shunchun, Lin Qingyu, Zu Wenchuan, Hai Ran, Zhu Xiangping, Lu Zhi, Nie Shuzhen, Lian Fuqiang, Liu Yang, Lin Weiran, Sun Sining, Hou Liquan, Liu Yanli, Liu Zheng, Tang Jing, Li Xin, Zhong Qixiu. Laser induced breakdown spectroscopy

1 Scope

China's national standard for laser-induced breakdown spectroscopy. It specifies the terms and definitions, the basic principles, the test conditions and the equipment. LIBS analyses a material by focusing a short laser pulse onto it, which vaporises a microscopic amount and creates a plasma; the light that plasma emits as it cools carries the emission lines of every element present. What makes it valuable is what it does not need: no sample preparation, no dissolution, no vacuum, no consumables, and no contact. It can be done at a distance through a window, on a moving conveyor, on a hot surface, or on a sample too dangerous to handle - which is why it is used for sorting scrap metal, for controlling molten metal composition in real time, for identifying materials in nuclear facilities, and on Mars rovers. Its weakness is quantification: the plasma's behaviour depends on the matrix, so calibration is the hard part and is where the standard's test conditions do their work.

This standard specifies the terms and definitions, basic principles, test conditions, equipment and devices, samples, and test procedures of laser-induced breakdown spectroscopy. Procedures, data processing and test reports. This standard applies to the detection and analysis of chemical elements of solid, liquid and gaseous substances.

2 Normative references

The following documents are essential for the application of this document. For dated references, only the dated version applies to this article Pieces. For undated references, the latest version (including all amendments) applies to this document.

GB 7247.1 Safety of laser products. Part 1. Equipment classification and requirements

GB/T 13966-2013 terminology for analytical instruments

GB/T 14666-2003 Analytical Chemistry Terms

3 Terms and definitions

The terms and definitions defined in GB/T 13966-2013 and GB/T 14666-2003 and the following apply to this document.

3.1 Plasma is formed by laser ablation of the substance to be analyzed, in which excited atoms, ions or molecules transition to low energy levels or ground states At that time, photons with a specific energy are emitted outward to form a characteristic spectrum, thereby obtaining the chemical composition or other characteristics of the substance to be analyzed.

3.2 Laser-induced plasma Plasma generated by laser ablation.

Note. The above plasma generally contains electrons, atoms, molecules, positive and negative ions, and micro-nano particles.

3.3 Standard sample It has the accuracy to meet the needs of analysis, assign value to the substance to be analyzed, evaluate the measurement method, and calibrate or verify the substance of the equipment.

3.4 Calibration curve Under specified conditions, it represents the relationship between the content of the element to be analyzed and the measured spectral intensity value.

Note 1. The calibration curve is also called the calibration curve.

Note 2. Rewrite GB/T 13966-2013, definition 2.89.

3.5 Qualitative analysis Determine whether the element to be analyzed contains the element according to the characteristic spectral line of the laser-induced plasma spectrum Analytical methods.

Note 1. Analytical methods for classifying substances based on spectral characteristics are also called qualitative analysis.

Note 2. Rewrite GB/T 13966-2013, definition 2.2.