

现代应用光学

激光诱导击穿光谱法测量煤粉流的控制因素

陈世和¹, 陆继东², 张博², 陈华忠¹, 姚顺春², 李军¹, 潘刚², 张曦¹

1. 广东电网公司 电力科学研究院, 广东 广州 510600;

2. 华南理工大学 电力学院, 广东 广州 510640

摘要: 用激光诱导击穿光谱(LIBS)法直接检测煤粉流时需要主要控制因素进行优化, 本文采用正交实验法考察了3个主要控制因素: 功率密度、积分延迟时间和单位截面流量对LIBS测量煤粉流的影响。选用粒径小于0.2 mm的煤粉作为实验样品进行了统计分析和方差分析。结果显示: 在实验所选取的参数范围内, 功率密度、积分延迟时间对有效激发率有显著影响, 单位截面流量的影响程度最低。优化后的方案为: 功率密度 9.4×10^{11} W/cm², 积分延迟时间1 500 ns, 煤粉流量根据经济性原则在合理范围内选取。得到的结果表明该方法可用于指导煤粉流的实际在线测量。

关键词: 激光诱导击穿光谱 煤粉流 有效激发率 正交实验

Controllable factors in detection of pulverized coal flow with LIBS

CHEN Shi-he¹, LU Ji-dong^{2*}, ZHANG Bo², CHEN Hua-zhong¹, YAO Shun-chun², LI Jun¹, PAN Gang², ZHANG Xi¹

1. Electric Power Research Institute of Guangdong Power Grid Co., Ltd., Guangzhou 510600, China;

2. School of Electric Power of South China University of Technology, Guangzhou 510640, China

Abstract: It is necessary to optimize operable factors in measurement of pulverized coal flow by Laser induced Breakdown Spectroscopy (LIBS). Therefore, this paper investigated the effects of three main operable factors, irradiance, integration delay time and the rate of flow per unit area on the measurement of pulverized coal flow by LIBS based on orthogonal experiments. Pulverized coal was chosen for the experimental sample and the statistic analysis and variance analysis were performed. Experiment indicates that the irradiance and integration delay time are two remarkable factors for the effective excitation rate and the following is the rate of flow per unit area. The optimum parameters of control from the experiment are the irradiance of 9.4×10^{11} W/cm², the integration delay time of 1 500 ns, and the rate of flow is selected reasonably based on economy principles. The results obtained demonstrate that the method can direct the practical measurement of pulverized coal flows in real time.

Keywords: Laser-induced Breakdown Spectroscopy (LIBS) pulverized coal flow effective excitation rate Orthogonal experiment

收稿日期 2013-01-07 修回日期 2013-04-14 网络版发布日期 2013-07-15

基金项目:

煤粉颗粒流的激光诱导击穿光谱特性及其测量方法研究; LIBS直接检测流动状态煤粉特性的关键技术研究

通讯作者: 陆继东

作者简介: 陈世和(1965-), 男, 广东阳春人, 高级工程师, 工学硕士, 热工所所长, 长期从事电厂生产过程自动化控制系统开发研究和生产管理的工作。

作者Email: jdlu@scut.edu.cn

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