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INTRODUCTION

In recent years, laser-induced breakdown spectroscopy (LIBS),[1,2] as a nascent analytical technique, has made significant strides. The principle of LIBS involves using a pulsed laser to ablate plasma onto sample surfaces, collecting emission light as spectra, and analyzing the spectra to determine the elemental compositions. The applications of LIBS have spanned various scientific disciplines, enabling rapid, *in situ*, and non-destructive elemental analyses.

The field of LIBS has undergone recent advancements, including fundamental studies, novel or improved methodologies, new applications, and new data processing methods. These developments have brought in enhanced detection limits and improved spatial resolutions. All in all, LIBS has become a valuable tool for scientific research and industrial applications.

BACKGROUND

This special issue provides a concise overview of the current state of LIBS, comprising a range of research articles covering various aspects of LIBS such as environmental science,[3–5] materials,[6] food and agricultural sciences,[7,8] and optics.[9–11] By featuring cutting-edge research efforts, this collection serves as a timely and important resource for scientists, engineers, and practitioners interested in LIBS and its impact on their respective fields.

SUMMARY OF AREAS COVERED

In the field of environmental science, LIBS has been developed a lot in detecting aerosols. Liu's group has conducted significant research in online detecting of aerosols in different scenarios.[4,5] For example, they applied LIBS to the online detection of smoke and ash from the burning of three common types of incenses (ambergris, musk, and Tibetan). Principal component analysis and error back propagation training artificial neural networks were used to classify the smoke and ash from different incenses, obtaining high recognition accuracy.[5] Moreover, they also applied LIBS with machine learning algorithms to online and *in situ* detection of kitchen oil fumes in five kitchen scenes with a recognition accuracy of 98.60%.[4]

In the field of materials, Li *et al.*[6] proposed a novel strategy by heating samples and adding potassium chloride to the LIBS system to improve the quality of the spectral signal and increase the detection sensitivity.

In the area of food and agricultural sciences, Zhang *et al.*[7] proposed a multidimensional spectral information LIBS (MSI-LIBS) to improve the qualitative accuracy of foreign protein adulteration in milk powder. The classification results, based on MSI-LIBS, demonstrated the better performance of LIBS classification. Li *et al.*[8] applied LIBS to investigate the Mg/Ca ratio in cultured seashells of two scallop species (*Chlamys farreri* and *Patinopecten yessoensis*). The results indicated that LIBS could track Mg/Ca variation on the cross-section of the scallop shell (*Chlamys farreri*), demonstrating that LIBS can be developed as a diagnostic tool in seashell cultivation.

In the area of optics, many researchers have focused on the optimization of laser sources. Double-pulse LIBS (DP-LIBS) was developed in many scenes. Deng *et al.*[10] compared the spectral line intensities and sensitivities of rare earth elements in rare earth ore samples between DP-LIBS and single-pulse LIBS (SP-LIBS), demonstrating that the DP-LIBS based on a single Nd:YAG laser can better improve the signal intensity and sensitivity of Y, La, Yb, and Dy elements in rare earth ore samples. Moreover, Luo *et al.*[11] employed the collinear long-short DP-LIBS (LS-DP-LIBS) into the detection of underwater copper samples. The results showed a significant signal improvement and the feasibility of the underwater measurement of metal samples using the collinear LS-DP-LIBS. Kumar *et al.*[3] explored the early detection and warning of standoff bio-threats using ultraviolet laser wavelengths. This work presents the results of detection experiments conducted to detect bio-aerosol from a standoff distance of nearly 2 km using laser scattering and ultraviolet laser-induced fluorescence (UV-LIF) lidar in the presence of potential interfering molecules (molecules having spectra overlapping with biological warfare agents). Meanwhile, based on the strength of high efficiency, good beam quality, and high reliability in fiber lasers, Lv *et al.*[9] developed a nanosecond fiber laser in LIBS to determine copper, magnesium, and manganese in aluminum alloys, providing a convenient method for the rapid elemental analysis of aluminum alloys.

CONCLUSIONS

This special issue on LIBS showcases the current state of the field and presents the latest advancements, challenges, and applications. This special collection also aims to stimulate further research and promote LIBS as a versatile analytical technique. The Guest Editors hope that this special collection will be enjoyed by the scientific community, ultimately contributing to the progress and innovation in LIBS and its related fields.

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