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Enhancing Reproducibility in LIBS of Micro and Sub-micron Particles Using a Diluted Epoxy Coating Technique

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Abstract: Laser-Induced Breakdown Spectroscopy (LIBS) is a multi-purpose, high-speed elemental analysis method, in which high-energy laser pulses are employed to create plasma on the sample surface. As plasma cools, radiation from it reveals the target's elemental composition. While LIBS is well known on average for sensitivity and rapidity, applying LIBS to fine powders, i.e., particles measuring in the range of microns and sub microns, typically suffers from poor reproducibility due to sample loss during laser ablation. Here, we present a surface stabilization method using a thin epoxy coating layer to optimize particle retention. We dilute epoxy hardner with ethanol and evaluate sequentially at different ratios and establish the optimal compromise between maintaining signal integrity and minimizing particle displacement. We show that the application of the 1:750 (v/v) ratio of the epoxy-to-ethanol solution in microvolume coatings significantly enhances the reproducibility and sensitivity of LIBS measurements. This method provides an encouraging solution for improving quantitative LIBS analysis for fine particle systems, with opportunities in biomedical diagnosis, environmental protection, and material science.

Biography: Sandaruka Jayasooriya is a Ph.D. student in the Department of Physics at Southern Illinois University Carbondale (SIUC). She received her Master's degree in Physics from Southern Illinois University and her Bachelor's degree in Physics from the University of Jaffna, Sri Lanka. Her research interests lie in biomedical applications of Laser-Induced Breakdown Spectroscopy (LIBS), materials characterization, and diagnostic techniques.