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Quantitative analysis of phosphorus in phosphogypsum-waste using CF-LIBS

Using calibration-free laser-induced breakdown spectroscopy, this study proposes a unique approach for determining phosphorus (P) content in phosphogypsum (PG) waste samples (CF-LIBS). The PG-LIBS spectrum was created using a 50 ml Q-switched Nd: YAG laser. The emission intensity and sharp broadening for PI characteristic lines 213.61, 214.91, and 215.40 nm under non-purged (air) and purged (helium) conditions were used to describe plasma development using electron density Ne and electron temperature Te. Te and Ne concentrations were shown to alter linearly with P concentrations of 4195, 5288, 6293, and 6905 ppm.

For the non-purged PG, plasma Te and Ne levels rose from around 6900 to 10000 K and 1.1×10^{17} to 3.4×10^{17} cm⁻³, respectively. The Te and Ne of the PG purged with helium, on the other hand, varied from 8200 to 11000 K 1.4×10^{17} to 3.5×10^{17} cm⁻³, respectively. Te and Ne values, it is concluded, offer a fingerprint plasma characterization for a particular P content in PG samples, which may be utilized to detect P concentration without a comprehensive study of the PG. These findings represent a significant breakthrough in the field of environmental spectrochemical analysis.

Biography

Walid Tawfik is the Chairman of the Department of Laser Applications at Cairo University, Egypt. He is a senior member of different international professional societies like IEEE, OSA, APS, and SPIE. He has collaborated with Georgia Tech USA, University of Electro-Communications Japan, POSTECH University of South Korea, King Saud University of Saudi Arabia, Max-Planck Institute of Germany and Lodz University of Tech, Poland.

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