SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

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A PRECISE QUANTITATIVE ANALYSIS EMPLOYING AN IN-SITU ROVER BASED LIBS INSTRUMENT FOR LUNAR SURFACE EXPLORATION

Abstract

Our team at 'Laboratory for Electro-Optics Systems-LEOS' is currently under development of a miniaturized in-situ spectroscope that would be flown in India's next lunar mission, Chandrayaan-2. The instrument, named 'Laser Induced Breakdown Spectroscope-LIBS' would be housed to the bottom of the lunar rover to execute elemental analyses from a distance of 200 mm. Suiting the mission constraints in terms of weight, size, power and available lens-to-surface distance, a prototype LIBS instrument of total mass of 1.5 kg that consume less than a 5 Watt power is developed. The developed proto-LIBS model supports various operational modes that that will aid to obtain the high quality science output from the instrument; even from the samples that are dust covered. Currently its performance, sensitivity and limit-of-detection tests are in progress along with the calibration, characterization and realization of matrix effects-free data analytical method. Realization of such a data analytical method which can efficiently and accurately analyze the complex LIBS spectra is of great importance in evaluating the analytical ability of LIBS. This model is based on the generation of effective calibration curves of the elements that are commonly found in lunar rock forming minerals. Nearly 60 types of standard and certified reference samples, namely GBW 07114, GBW 07104, GBW 07015, SRM 688/691/699, VS 811-89, JF-1, VS 2119-81, VS R28, SARM 4, VS 2887-84, JR-1, plagioclase, ilmenite, anorthite etc., are procured to generate the empirical database with respect to various instrument and experimental conditions (addressing the matrix-effects) under vacuum conditions of 10-6 mbar level. Currently experimental trials, data base generation and efforts towards the modeling of precise quantitative analysis are in progress. This paper principally focuses on the various stages of realization scheme for a matrix-free data analytical model and through this paper authors would like to express their views on various spectral observations of experimental investigations that are performed under diverse operational conditions, which ultimately lead to define sensitivity and limit-of-detection limits.