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Development of a Series of Lithium-Containing Glass Calibration Standards

Hana Kaňková, Branislav Hruška, Lenka Buňová, Jaroslava Gombárová, Katarína Faturíková, Dagmar Galusková

A. Dubček University of Trenčín, Slovakia

Biography

Dr. Hana Kaňková
Researcher, Central Lab, FunGlass – Centre for Functional and Surface Functionalized Glass,
A. Dubček University of Trenčín, Slovakia

Abstract

Lithium-containing minerals are the source of new technologies. Accurate assessment of the chemical composition and detection of impurities is essential in the evaluation and search for new raw materials discoveries. One of the methods for the evaluation of geological samples is laser ablation coupled to ICP-MS. This method uses direct analysis of a solid sample and allows determination of the overall composition as well as characterization of mineral grains, zonation, or distribution of element in the sample.

The use of a suitable standard (similar to the analysed samples in matrix and elemental content) is essential for the accurate interpretation of measured data. Due to the limited supply of commercial standards, the solution is to prepare in-house glass calibration material in the laboratory.

Series of glasses with matrix SiO_2-Na_2O-CaO-Al_2O_3-K_2O-Li_2O were prepared. The main composition was based on the NIST standard 61X series. The Li_2O content was incrementally increased up to 11 wt.%. To extend the applicability of the standard to the analysis of impurities, the glasses may additionally contain 0.05 wt.% or 0.1 wt.% of selected oxides.

The process of preparing these standards was optimized by extending the melting time, increasing the number of stirrings during melting, and also by increasing the melting temperature. During optimization of the melting process, melt samples were taken at different time intervals of 4, 5, 6, and 7 hours.

The composition of the prepared glasses was determined by XRF and ICP-OES. The homogeneity was evaluated by laser ablation. The relative standard deviations of isotopes were calculated from the measured values of ablated spot intensities of samples intended as reference materials and commercially obtained NIST 610 reference material . Glasses with chemical homogeneity <5% determined with LA-ICP-MS were fulfilling the criteria for the in-house glass standards and can be applied for Li-containing raw materials.