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LIBS Analysis of Glass Content, including Light Elements Li, Be, B.

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The LIBS method is characterized by favorable possibility of direct element content measurements in any object with minimum sample preparation or without it. For measurements of glass content with the use of Laser Elemental Analyzer LEA-S500, produced by SOL instruments, flat polishing of a part of glass sample within 10-30 seconds has been carried on.

LEA-S500 demonstrates its advantageous capabilities in glass measurements, i.e. determination of a wide range of elements, including such light elements as Li, Be and B, which have been escaped the analysts' attention for decades. In many respects it was predetermined by limitations of the applied XRF method for determination of the elements of periodic table with small atomic weight.

For the instrument calibration in the whole range of mass fraction of “light” oxides Li2O and BeO in glasses the standard samples have been initially prepared by powder samples alloying. Sintering and alloying have been executed on a clean quartz sand substrate at rather low temperatures (to 1000oC). The crushed food tare glass with minimal analytical signal what corresponds to minimal Li and Be content has been used as the main matrix.

Reactive Li2CO3 (chemically pure) and powder of beryllium bronze standard sample (with Be mass fraction of 1.59%) have been used as additives.

Further calibration of the instrument and the analysis has been performed with the obtained values of Li2O and BeO mass fractions using monolithic matted glass samples. The detection limit of Li, Be and B in glass 0.015, 0.07 and 3.0 ppm, respectively has been obtained with the LEA-S500 instrument at the selected mode of analysis (300 pulses at 20 Hz). The results of measurements of mass fraction of 19 oxides in a line of various samples of glasses for food, perfumery and cosmetic as well as for electric bulb glass, have been reported.The selection of glass samples (of European and American producers) has been casual. The value of estimation of the analytical signals of other non-analyzed oxides characterizes the level of coverage of their full chemical composition: their total content doesn't exceed 0.03%.

The importance of the data on “light” elements content has been demonstrated by example with BAM S004 sample, certified for the content of hexavalent and total chrome. Based on obtained data specification of the main SiO2 oxide content (70.1%, instead of 70.9% specified in the certified document) has been improved.

Based on the results of the measurements, executed with the help of LEA-S500 elemental analyzer, the proportional relation between the concentrations of Li2O and BeO (approximation validity coefficient R2=0.66) in total glass samples has been observed.