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New reference values for NIST SRM 610-617 glasses following ISO guidelines

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We present new reference values for the NIST SRM 610-617 glasses, which were obtained from a large number of analytical data following ISO guidelines and the protocol for certifying reference materials of the International Association of Geoanalysts (IAG) as close as possible. Uncertainties at 95 % confidence level have been determined for bulk- and microanalytical purposes. Our approach is quite different from former compilation procedures (e.g., Pearce et al. 1997) as the new reference values have the status of certified values. The data were derived through a metrological valid procedure, have assigned small uncertainties and satisfy present-day requirements of data quality.

In contrast to a certification program, where guidelines of the collaborative study have to be developed, which should account for establishing and demonstrating traceability, we used two different kinds of element data: new analytical data obtained by ID-ICP-MS, LA-ICP-MS and EPMA, and the nearly complete data set of the GeoReM database (about 5000 concentration data for the NIST glasses). Data quality was checked by the application of the Horwitz function for the identification of "outliers" and by a careful investigation of analytical procedures. Because NIST SRM glasses are mainly used in microanalysis, we have determined quantitatively possible inhomogeneities of major and trace elements by EPMA and LA-ICP-MS using different spot sizes of 80, 40 and 25 μm, corresponding to test portion masses of 1, 0.1 and 0.02 μg, respectively. Most lithophile and some chalcophile/siderophile elements are homogeneously distributed in the glass wafers. Although avoiding the rim region (about 1 mm) of the glass wafers, we found moderate inhomogeneities of 16 chalcophile/siderophile elements and gross inhomogeneities of Ni, Se, Pd and Pt at small test portion masses.

Most reference values for the NIST SRM glasses have a high degree of confidence with uncertainties of less than 3 %. Even for many heterogeneously distributed trace elements and low test portion masses, reliable information values with uncertainties of better than 10 % are reported. Our values for NIST SRM 610-611 and 612-613 differ up to 10 % from the compilation values of Pearce et al. (1997). Discrepancies of some elements (e.g., P, S, Cl, Ta, Re) are even higher.