STANDARD SAMPLES — A BASIS FOR THE METROLOGICAL SYSTEM DESIGNED TO ENSURE HIGH QUALITY IN THE PRODUCTS OF FERROUS METALLURGY


Standard samples specifying the compositions of substances and materials were set up in the Soviet Union for the first time in the field of ferrous metallurgy. These standards found many applications in the analytical chemistry laboratories of industrial undertakings for monitoring the accuracy of measurements relating to the composition of materials. At the present time the Soviet Union has 493 types of standard samples associated with the composition of raw materials and finished products, and these are far more widely representative than the analogous lists of standard samples in any of the other industrially developed countries. Under the guidance of the Standard Samples Institute of the Central Scientific Research Institute of Ferrous Metallurgy, an investigation into the composition of samples is being systematically executed by more than 180 of the most qualified analytical chemistry laboratories belonging to a variety of departments in the popular economy. Each year standard samples produced by the Standard Samples Institute are sent to over 3000 undertakings in the Soviet Union and sixteen other countries.

In addition to this, the metallurgical undertakings have created more than 1600 intra-factory samples on the basis of the all-union standard samples, and undertakings of the metal-processing departments at least 1000.

Considerable work is also being done on improving the quality of standard composition samples. At the present time practically all the standard samples produced in the ferrous metallurgy field have successfully passed expert metrological assessment and been included in the State Register of Measures and Measuring Instruments of the USSR.

An analysis of the state of analytical testing in this field showed that one of the most important aspects lay in increasing the effectiveness of the use of standard samples, primarily for monitoring the quality of measurements relating to the measurement of composition in analytical chemistry laboratories.

Experience in the production and application of standard samples regarding the composition of materials in ferrous metallurgy enables us to analyze certain aspects of the problem of supplying these to the popular economy; the solution of such problems is certainly extremely vital from the point of view of improving metrological provisions for measurements associated with the composition of substances and materials.

This applies chiefly to the question of refining the concept "standard sample" as a metrological medium. The existing terminological inexactitude is by no means an innocuous circumstance, since it reflects a lack of clarity in the concepts themselves, which in turn influences such important scientific methodical problems as the classification of standard samples, their mutual compatibility and metrological functions, practical problems of the correct planning of research, the organization of categories, and so on.

It is very important that attention should be directed to the settling of these points at the present time, especially as the All-Union State Standard 14263-69 is now being revised.

A basic feature in solving the problem of standard-sample categorization must lie in extending general metrological requirements, principles, and terminology as broadly as possible to measurements of composition.

Translated from Izmeritel'naya Tekhnika, No. 10, pp. 12-14, October, 1975.
rather than continuing with earlier attempts to set quantitative analysis in opposition to other forms of measurement.

Vast reserves of efficiency are to be found in a systematic approach to the creation of classified lists of standard of composition samples. The realization of this approach involves, first of all, departing from the tradition common to all industrially developed countries of producing mutually unrelated, single-category standard samples intended for testing the correct composition of materials belonging to a single, strictly defined brand. A classified list of standard composition samples relating to materials used in ferrous metallurgy is even now being created as an internally consistent single system of standard measures of composition. This list is based on the present state of quantitative analysis and a knowledge of the analytical-chemical properties of the components under test, and includes information as to the content of any practically-important component in each group of materials in this field over the whole range of concentrations in current use.

In planning a classified list of standard samples of composition it is essential to match the system of standard samples with other standards concerned with technical conditions and brands of materials, and also standards concerned with methods of quantitative analysis, as well as with the accuracy of working composition measurements.

This matching of the classified list of standard samples with other aspects of the system of metrological provision for composition measurements is certainly not one of passively submitting the classification to rigid preset requirements.

On the contrary, standard samples form one of the most active links in ensuring the uniqueness of composition measurements, and fundamentally influence the remaining links and the system as a whole. As a result of this, the matching of lists of standard samples in ferrous metallurgy has inevitably grown into a mutual coherence between the various factors defining the system of metrological provision for composition measurements.

A second very important problem in optimizing the development of standard composition samples is a transition from the traditional production of single-category samples to the creation of mutually coherent standard measures of composition of various orders and various certified accuracies together with metrological procedures strictly defined for each category of measures. Modern ferrous metallurgy has developed a three-level system of standard measures of composition, including the original standard samples followed by standard samples of the first and second subsidiary classes.

The original standard samples play the part of a scientific-technical base for storing and reproducing quantities characterizing (to the greatest possible accuracy which the country can provide) the content of any practically-important component in each form of material of the particular field over the whole range of concentrations used in industrial processes and scientific-research work; they serve to compare the accuracy of composition measurements achieved in the ferrous metallurgy field with the best of all worldwide criteria, and also to transmit measuring information to the subsidiary first-class standard measures.

In view of the extreme difficulty and high cost of creating each original standard sample, the upper link in the system of coherent standard measures of composition contains a strictly limited number of sample types.

The main aim in the use of standard measures should be that of certifying standard second class samples and in individual cases checking operational ways and means of measuring compositions.

In contrast to the upper links of the standardization system, the standard second-class samples should constitute the most numerous (and constantly replenished according to the requirements of industry) groups of standard measures for testing measuring media; this group should be developed by specialized institutes or laboratories, and also by industrial undertakings, on the basis of technical norm documentation common to all such organizations.

Calculations show that the development of a departmental system of mutually-compatible standard measures of composition is not only a means of increasing the quality of standard samples but also practically the only way of solving the problem of furnishing the popular economy with the required number of standard samples of composition.

It should be noted that the possibilities of improving metrological provisions for composition measurements on the basis of standard samples have by no means been fully utilized. The reason for this is not only the extreme inaccessibility of the samples (only the countrywide organizations of ferrous metallurgy have the resources needed to provide the minimum of standard and intra-factory standard samples required) but also the fact that, until recently, there had been no methodical scheme for applying standard samples to the solution of a wide range of metrological problems. Chief among these problems is the objective assessment of the quality of composition measurements.