



Chemical analysis of light metals and their alloys — Statistical interpretation of inter-laboratory trials

Analyse chimique des métaux et des alliages légers — Interprétation statistique des circuits interlaboratoires

Technical Report 7242 was drawn up by Technical Committee ISO/TC 79, *Light metals and their alloys*, and has been approved by the majority of its members.

Sub-committee ISO/TC 79/SC 1 considered it preferable to publish this document in the form of a Technical Report, as its purpose is to provide information which could not be considered as a suitable subject for standardization but which is useful for users of standards confronted with the complex problems encountered during statistical studies resulting from round-robin, comparative analytical trials.

0 Introduction

The purpose of inter-laboratory trials is to compare the results obtained in terms of two parameters : the methods and the laboratories.

The following combinations can therefore be considered :

- a method tested by several laboratories;
- several methods tested within one laboratory;
- two or more methods tested by several laboratories.

As an example, see tables 1, 2 and 3 relating to the determination of chromium.

Whichever combination is selected for the trial, interpretation of the results seeks to establish whether the recorded numerical differences are mainly due to the influence of the parameter studied (laboratory, method) or whether they can be explained by the dispersion observed between individual results (repeatability or experimental error). In all cases, the results of the statistical examination should be interpreted from an analytical viewpoint. The repeatability of a method can be sufficiently good for the small inter-laboratory differences to be significant from the statistical point of view, although they can be considered negligible in practice. Conversely, poor repeatability does not imply that differences considered important by the user are significant.

Statistical interpretation, even when using very sophisticated calculation methods, has never corrected the failures of a method, nor has it improved the results from a laboratory.

It is a tool leading very often to conclusions, the essential merit of which is objectivity.

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1 Scope and field of application

This Technical Report constitutes an attempt to explain the numerical results of a statistical examination in the simplest possible way and to show how statistical results can be used in laboratory practice.

This simplified method is applicable when the number of laboratories is not more than 20 and when the number of results per laboratory is not more than 10.

2 Symbols

$\bar{x}_n$: arithmetic mean of n results;

S_n : estimated standard deviation of n results;

$S_{\bar{x}_n}$: estimated standard deviation of the mean of n results : $S_n/\sqrt{n}$;

$S_n/\bar{x}_n$: relative standard deviation or coefficient of variation, as a percentage.

NOTE — To add or subtract two standard deviations, determine the sum or difference of their squares and take the square root.

3 Example of interpretation of statistical parameters — Determination of chromium

Results of an inter-laboratory trial of two methods, A and B, for the determination of chromium are given. It is not intended to give a complete interpretation of the results, but to show the possibilities of interpretation from the parameters established.

Individual results are given in tables 1 and 2.

The statistical parameters relating to the comparison of both methods are given in table 3. These parameters can be explained, or at least translated into, more practical formulae without requiring recourse to basic statistical documents. Reference may be made to a standardized method of calculating these parameters.

Table 4 summarizes explanations relative to the parameters given in table 3.