INTERNATIONAL STANDARD

ISO 11952

Second edition
2019-05

Surface chemical analysis — Scanning-probe microscopy — Determination of geometric quantities using SPM: Calibration of measuring systems

Analyse chimique des surfaces — Microscopie à sonde à balayage — Détermination des quantités géométriques en utilisant des microscopes à sonde à balayage: Étalonnage des systèmes de mesure

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Foreword

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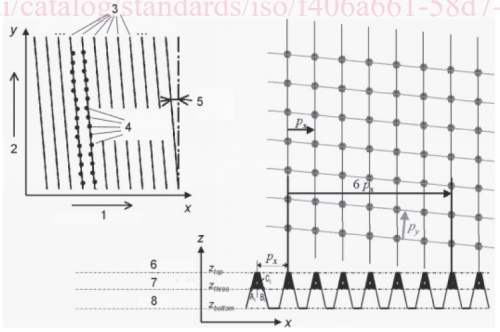
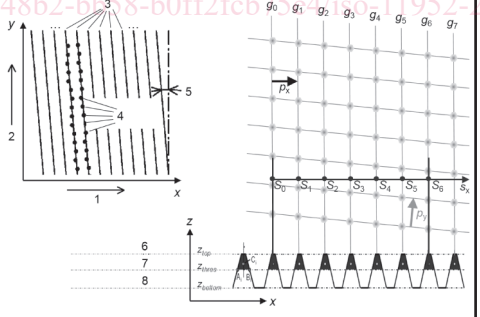
This document was prepared by Technical Committee ISO/TC 201, *Surface chemical analysis*, Subcommittee SC 9, *Scanning probe microscopy*.

This second edition cancels and replaces the first edition (ISO 11952:2014), of which it constitutes a minor revision. The changes to the previous edition are as follows:

		Previous edition	Revised edition
Figure 1		“interferometery”	“interferometry”
Figure 1	Note	“The calibration of a user’s SPM by means of traceably calibrated measurement standards is the object of this International Standard (done by the user).”	“The calibration of a user’s SPM by means of traceable calibrated measurement standards is the object of this document (done by the user).”
Clause 4	N_i	“N_i”	“N_{ij}”
Clause 4	r	“tip”	“tip radius”
Clause 4	α_m	“thermal expansion coefficient”	“thermal expansion coefficient of the specimen”
Clause 4	*ytx*	“positional deviation Δx measured along a y-coordinate line”	“straightness deviation Δx measured along a y-coordinate line”
Clause 4	*yty*	“straightness deviation Δy measured along a y-coordinate line”	“positional deviation Δy measured along a y-coordinate line”
Clause 4	*ztz*	“straightness deviation Δz measured along a z-coordinate line”	“positional deviation Δz measured along a z-coordinate line”
6.3.1	Title	“Kinds of external influence”	“Sources of external influences”
6.3.1	First sentence	“As SPMs are most sensitive to interference from the environment, the following quantities are to be accounted for”:	“As SPMs are very sensitive to interference from the environment, the influences of the following quantities need to be determined”:

		Previous edition	Revised edition
6.3.1	Fourth bullet	"mechanical vibrations (e.g. structural vibrations, foot fall sounds/human traffic, pumps)";	"mechanical vibrations (e.g. structural vibrations, human traffic, pumps)";
6.4	a) and b)	a) For measurement b) For installation or familiarization of the staff	a) and b) switched
7.3.4	Second bullet	"Adjust the z-position of the scanner in such a way that the z-scanner operates symmetrically around the central position in the z-deflection range (see also Figure 18)."	"Adjust the z-position of the scanner in such a way that the z-scanner operates symmetrically around the central position in the z-deflection range as illustrated in Figure 17 around its medium (central) deflection, i.e. 50 % of its range"
7.3.7	Fourth bullet	"adjust the z-position of the scanner in such a way that the z-scanner operates, e.g. by 20% (see also Figure 20) above or below the central position in the z-deflection range (see also Figure 18 and 20)."	"adjust the z-position of the scanner in such a way that the z-scanner operates above or below the central position in the z-deflection range, i.e. symmetrically around 10 %, 30 %, 70 % and 90 % (as illustrated in Figure 17), in addition to the basic z calibration performed around 50 % deflection"
Figure 9	Title	"Flow diagram of calibration of the lateral axes[35]"	"Calibration of the lateral axes: materials, steps and methods[35]"
7.4.4	Seventh paragraph	"needs to" "great"	"should" "large"
7.4.4	Eighth paragraph	"(relatively feeble)"	"(low)"
7.4.5	2)	"(see also Figure 18)"	"as illustrated in Figure 15 and shown for the medium (central) deflection case in Figure 17."
7.4.7	Figure 10		
7.4.7	4) and Note 1	"Appurtenant"	"relevant"
7.4.8	Second bullet	"In good gratings, the mean values of the pitches of all the straight lines are a good approximation and should be used for further evaluation. If this is not the case, the parallelism of the straight lines is to be forced by fitting as above."	"In good gratings, the fit lines g_0 to g_n are nearly parallel so that the mean value of the gradients of all these straight lines is a good approximation and should be used for further evaluation. If this is not the case, the parallelism of the straight lines is to be forced by fitting as above."
7.4.8	Eighth bullet	"(example in Figure 15)"	"(the example in Figure 12 shows a polynomial fit of the third degree)"

		Previous edition	Revised edition
7.4.8	Note 2	“In the case of clear deviations of the specimen temperature (e.g. in deep-temperature applications) from the reference temperature 20 °C in particular, for which the calibration of the measurement standard is valid, the thermal expansion is to be accounted for.”	“The certified pitch values of a transfer standard are valid for a certain reference temperature, typically 20 °C. In case of significant deviations of the sample temperature from the reference temperature (e.g. in low-temperature chambers or if the sample is heated in the particular setup), the material-dependent thermal expansion is to be taken into account.”
7.5.7.2.1	Second paragraph	“For the one straight line — besides the parallelism requirement — the determination uses only an area C in the middle of the indention or elevation whose width can be selected by the user; it is usual to select one (according to ISO 5436 1) to two-thirds (Figure 18) of the total width w of the indention/elevation.”	“For the one straight line — besides the parallelism requirement — the determination uses only the section C in the middle of the indention or elevation whose width w_m can be selected by the user; it is usual to select one (according to ISO 5436-1) to two-thirds (like in the example shown on the left of Figure 18) of the total width w (defined as full-width at half maximum) of the indention/elevation.”
7.5.7.2.1	Third paragraph	“Taking account of the parallelism requirement, the second straight is selected through two areas A and B which lie symmetrically about the indention/elevation and usually show the same width as C. The distance of A”	“Taking account of the parallelism requirement, the second straight is selected through two sections A and B which lie symmetrically about the indention/elevation. The lengths w_s in sections A and B are identical, but might be different from w_m. The sections A and B should not start/end with the beginning/end of the profile (scanline), as irregularities in height measurement are to be expected especially at the beginning/end of scanlines. A spacing w_l to the left of section A and w_r to the right of section B should be allowed for. As a general rule, the total length of the measured profile should be at least 3*w*. The distance we of A”
7.5.7.2.1	Fourth paragraph	“As to the mathematics, the determination of the step height, *h*, is reduced to the calculation of only one regression line by appropriately shifting the points area by area by +*h*/2 and −*h*/2, respectively.”	“As to the mathematics, the determination of the step height, *h*, is reduced to the calculation of only one regression line by least squares approximation with h being the fit variable. This reduction to only one regression line is achieved by introducing a vertical shift of the data points in the sections A, B and C according to the following rules”:
7.5.7	Figure 18 title