

TECHNICAL SPECIFICATION

**Nanotechnologies – Description, measurement and dimensional quality
parameters of artificial gratings**



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parameters of artificial gratings**

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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
3.1 Basic terms	7
3.2 Grating terms	10
3.3 Grating types.....	11
3.4 Grating quality parameter terms	14
3.5 Measurement method categories for grating characterization	17
4 Symbols and abbreviated terms.....	18
5 Grating calibration and quality characterization methods	18
5.1 Overview.....	18
5.2 Global methods	18
5.3 Local methods.....	19
5.4 Hybrid methods	20
5.5 Comparison of methods.....	20
5.6 Other deviations of grating features.....	21
5.6.1 General	21
5.6.2 Out of axis deviations	21
5.6.3 Out of plane deviations	22
5.6.4 Other feature deviations	22
5.7 Filter algorithms for grating quality characterization.....	23
6 Reporting of grating characterization results.....	23
6.1 General.....	23
6.2 Grating specifications	24
6.3 Calibration procedure	24
6.4 Grating quality parameters	24
Annex A (informative) Background information and examples	25
Annex B (informative) Bravais lattices.....	34
Bibliography.....	38
Figure 1 – Example of a trapezoidal line feature on a substrate	8
Figure 2 – Examples of feature patterns.....	9
Figure 3 – Examples of 1D line gratings.....	12
Figure 4 – Example of 2D gratings	13
Figure A.1 – Result of a calibration of a 280 mm length encoder system which was used as a transfer standard in an international comparison [31].....	27
Figure A.2 – Filtered (linear profile Spline filter with $\lambda_c = 25$ mm) results of Figure A.1	28
Figure A.3 – Calibration of a 1D grating by a metrological SEM	30
Figure A.4 – Calibration of pitch and straightness deviations on a 2D grating by a metrological SEM.....	31

Figure A.5 – Results of an international comparison on a 2D grating by different participants and types of instruments	33
Figure B.1 – One-dimensional Bravais lattice	34
Figure B.2 – The five fundamental two-dimensional Bravais lattices illustrating the primitive vectors \vec{a} and \vec{b} and the angle φ between them	35
Figure B.3 – The 14 fundamental three-dimensional Bravais lattices	36
Table 1 – Comparison of different categories for grating characterization methods	21
Table A.1 – Grating quality parameters of the grating in Figures A.1 and A.2	28
Table A.2 – Grating quality parameters of the grating in Figure A.3	30
Table A.3 – Grating quality parameters of the grating in Figure A.4	32
Table B.1 – Bravais lattices volumes	37

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**NANOTECHNOLOGIES – DESCRIPTION, MEASUREMENT AND
DIMENSIONAL QUALITY PARAMETERS OF ARTIFICIAL GRATINGS**

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62622, which is a technical specification, has been prepared within the joint working group 2 of IEC technical committee 113 and ISO technical committee 229.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
113/133/DTS	113/143/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table. In ISO, the standard has been approved by 16 member bodies out of 16 having cast a vote.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- transformed into an International Standard,
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INTRODUCTION

Artificial gratings play an important role in the manufacturing processes of small structures at the nanoscale as well as characterization of nano-objects.

For example, in high volume manufacturing of semiconductor integrated circuits by means of lithography techniques, grating patterns on the photomask and the silicon wafer are optically probed and the resulting optical signal is analyzed and used for relative alignment purposes of mask to wafer in the different lithographic production steps in the wafer-scanner production tools. In semiconductor manufacturing as well as in other manufacturing processes requiring high positioning accuracy at the nanoscale, often length or angular encoder systems based on artificial gratings are used to provide position feedback of moving axes. Another area of application for artificial gratings in nanotechnology is their use as calibration standards for high resolution microscopes, like scanning probe microscopes, scanning electron microscopes or transmission electron microscopes which are necessary tools for the characterization of nanoscale structures.

The quality of the artificial gratings used for position feedback generally influences the achievable accuracy of alignment systems or positioning systems in manufacturing tools. This also holds for the application of artificial gratings as standards for calibration of image magnification of high resolution microscopes, where the quality of the grating plays an important role in the achievable calibration uncertainty of the standard and thus for the attainable measurement uncertainty of the microscope.

This technical specification concentrates on specifying quality parameters, expressed in terms of deviations from nominal positions of grating features, and provides guidance on the application of different categories of measurement and evaluation methods to be used for calibration and characterization of artificial gratings

NANOTECHNOLOGIES – DESCRIPTION, MEASUREMENT AND DIMENSIONAL QUALITY PARAMETERS OF ARTIFICIAL GRATINGS

1 Scope

This technical specification specifies the generic terminology for the global and local quality parameters of artificial gratings, interpreted in terms of deviations from nominal positions of grating features, and provides guidance on the categorization of measurement and evaluation methods for their determination.

This specification is intended to facilitate communication among manufacturers, users and calibration laboratories dealing with the characterization of the dimensional quality parameters of artificial gratings used in nanotechnology.

This specification supports quality assurance in the production and use of artificial gratings in different areas of application in nanotechnology. Whilst the definitions and described methods are universal to a large variety of different gratings, the focus is on one-dimensional (1D) and two-dimensional (2D) gratings.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO/TS 80004-1:2010, *Nanotechnologies – Vocabulary – Part 1: Core terms*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Basic terms

3.1.1 feature

region within a single continuous boundary, and referred to a reference plane, that has a defining physical property (parameter) that is distinct from the region outside the boundary