IEC TS 62607-6-24

Edition 1.0 2026-06

TECHNICAL SPECIFICATION

Nanomanufacturing - Key control characteristics -
Part 6-24: Graphene-related products - Number of layers of graphene: optical contrast

ICS 07.120

ISBN 978-2-8327-1338-9

IEC TS 62607-6-24:2026-06(en)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Nanomanufacturing - Key control characteristics - Part 6-24: Graphene-related products - Number of layers of graphene: optical contrast

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC TS 62607-6-24 has been prepared by IEC technical committee 113: Nanotechnology for electrotechnical products and systems. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
113/952/DTS	113/979/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts of the IEC 62607 series, published under the general title *Nanomanufacturing - Key control characteristics*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

INTRODUCTION

Graphene, as a pioneer of 2D materials, plays a critical role in many state-of-the-art applications, extensively involving electronics, optoelectronics, sensors, and energy storage. [1][1] Graphene has many desirable properties, e.g. high carrier mobility, broadband optical absorption, biocompatibility and excellent stability and hence has good prospects not only for basic research but also for various industrial applications. Large-area graphene film fabricated by chemical vapour deposition (CVD) method is one of the most promising candidates for commercialization. However, large-area CVD graphene films typically contain multilayer domains that occupy varying proportions of the surface area, which can significantly affect their electrical, mechanical and optical properties. Therefore, it is crucial to quantitatively assess number of layer distribution (i.e. the area proportions for various layer domains) in CVD graphene films for both research and application development.

There are many approaches for measuring number of layers of graphene films, such as transmission electron microscopy (TEM), Raman spectroscopy, optical microscopy, and atomic force microscopy (AFM). However, how to measure number of layer distribution is not specified yet. This will affect application development and commercialization of large-area CVD graphene film.

This document specifies a simple, high-throughput, and non-destructive approach to measure number of layer distribution of large-area CVD graphene film by optical contrast method. The basic principle and experimental approach of the optical contrast method are presented to identify number of layer distribution. This method relies on the statistical analysis of the optical contrast values of the pixels that make up the sample's optical images, and it is significantly more efficient than TEM, AFM and Raman spectroscopy characterization method. With light illumination corrections, the coverage ratio of monolayer and multilayer domains in large-scale CVD graphene can be obtained accurately.

1 Numbers in square brackets refer to the Bibliography.

1 Scope

This part of IEC 62607 establishes a standardized method to determine the key control characteristic (KCC)

– number of layer distribution

for CVD graphene film by

– optical contrast measurement

The number of layers and number of layer distribution of CVD graphene film is derived by G-channel contrast values.

This method is applicable for clean CVD graphene film without twisted multilayer structures on a SiO_2/Si substrate.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC TS 62607-6-11:2022, *Nanomanufacturing - Key control characteristics - Part 6-11:*

Bibliography

[1] ISO/TS 80004-13:2024, *Nanotechnologies - Vocabulary - Part 13: Graphene and other two-dimensional (2D) materials*

[2] Z. H. Ni, H. M. Wang, J. Kasim, H. M. Fan, T. Yu, Y. H. Wu, Y. P. Feng, and Z. X. Shen. Graphene thickness determination using reflection and contrast spectroscopy. Nano Letters, 2007, 7, 2758

[3] Y. Y. Wang, R. X. Gao, Z. H. Ni, H. He, S. P. Guo, H. P. Yang, C. X. Cong and T. Yu. Thickness identification of two-dimensional materials by optical imaging. Nanotechnology, 2012, 23, 495713