IEC TS 62607-6-23

Edition 1.0 2025-11

TECHNICAL SPECIFICATION

Nanomanufacturing - Key control characteristics -
Part 6-23: Graphene-related products - Sheet resistance, carrier density, carrier mobility: Hall bar method

ICS 07.120

ISBN 978-2-8327-0771-5

IEC TS 62607-6-23:2025-11(en)

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

Nanomanufacturing - Key control characteristics - Part 6-23: Graphene-related products - Sheet resistance, carrier density, carrier mobility: Hall bar method

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 62607-6-23 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
113/911/DTS	113/930/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 in 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 films are widely used in the fields of electronic devices, e.g. display, communication and wearable devices. Different applications have different requirements on carrier mobility and sheet resistance of graphene films, which determines the performance of graphene films. Carrier mobility and sheet resistance are the key control characteristics for quality control and product development of graphene films. However, there are large differences in carrier mobility extracted from devices in different structures even made from the same thin films. The sheet resistance varies by two or three orders of magnitude from the touch screen to the solar cell. At the same time, there is no unified test standard for device shape, electrode type, electrode contact method and measurement method.

As there is no widely accepted standard for the methods to measure devices, the measurement results cannot be compared and the quality of graphene films cannot be comprehensively evaluated. Therefore, there is an urgent need to draft a standard for the measurement of carrier mobility and sheet resistance in graphene thin films.

The document is developed to complete the fabrication and measurement of devices using cost-effective processes and equipment. Due to the high cost and low cost-performance ratio of photolithography processes and equipment, this document does not utilize photolithography processes and equipment.

This method, based on the Hall effect, is recommended for graphene thin film Hall devices with a carrier mobility of less than 10 000 cm^2/Vs. Currently, the applications of graphene mainly include transparent conductive films and flexible electrodes. Preliminary studies have shown that the mobility of graphene transparent conductive films and flexible electrodes at room temperature is below 10 000 cm^2/Vs [1] to [6][1], which is mentioned here merely for illustrative purposes.

[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)

– carrier mobility and sheet resistance

for graphene thin films by

– Hall measurement.

The carrier mobility is derived by the product of the Hall coefficient and the electric conductivity and the sheet resistance is derived by the product of the longitudinal resistance and the aspect ratio of a Hall device.

– The method is applicable for graphene thin film Hall devices with length and width greater than 100 micrometers.

2 Normative references

There are no normative references in this document.