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

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

Draft	Report on voting
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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.

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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– withdrawn, or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.