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Nanomanufacturing - Reliability and durability assessment - Part 3-2: Graphene - Ellipsometry measurement of graphene

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Nanomanufacturing - Reliability and durability assessment - Part 3-2: Graphene - Ellipsometry measurement of graphene

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

Draft	Report on voting
113/942/DTS	113/966/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 62876 series, published under the general title *Nanomanufacturing - Reliability and durability assessment*, 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– withdrawn, or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, a single layer of carbon atoms with each atom bound to three neighbours in a honeycomb structure, is an important building block of many carbon nano-objects, and possesses the excellent characteristics for various nanoelectronics devices, such as the high conductivity in the 2-dimensional structure. Graphene is also a promising candidate for atomically thin, flexible and transparent optoelectronic devices, various sensors, and the capping material on the electronic transport in ultra-scaled interconnects. Ellipsometry is a non-destructive optical tool to evaluate the dielectric properties, namely the complex index of refractive, of thin-film-shaped materials. Ellipsometry has the advantage of being able to evaluate a relatively large area of the film. Ellipsometry can be used to characterize thickness, roughness, composition, crystalline nature, and other properties of graphene.

This document offers the test method of ellipsometry to evaluate the reliability and the durability of graphene layers on a substrate.

1 Scope

This part of 62876 establishes a standardized method to determine

– volume fraction

for graphene by

– ellipsometry.

Thickness/composition measurements are evaluated by ellipsometry before and after the stability test. By model calculation, the volume fraction of graphene can be evaluated. Since the test method is non-destructive, it can be used to assess the reliability and durability of graphene films on production lines.

– For graphene-capped copper for Cu interconnects in a semiconductor engineering, for example, the reliability and durability of the capping layer are evaluated.
– Gas sensors, gas barriers, transparent electrodes for solar cells, etc. are being researched and developed.
– This method is useful for non-destructive and quantitative evaluation of the volume fraction of graphene to assess the reliability and durability.

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.

ISO/TS 80004-1, *Nanotechnologies - Vocabulary - Part 1: Core vocabulary*

3 Terms, definitions, and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO/TS 80004-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

– IEC Electropedia: available at http://www.electropedia.org/
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3.1 General terms

3.1.1
graphene
planar single layer of carbon atoms with each atom bound to three neighbours in a honeycomb structure

[SOURCE: ISO/TS 21356-1:2021 [1], 3.1, modified - "Planar" has been added to the definition and the Notes to entry have been deleted.]