PD IEC TS 62607-6-35:2025

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Nanomanufacturing — Key control characteristics

Part 6-35: Graphene-related products — Density: free-pouring, tapping and compressing method

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Nanomanufacturing - Key control characteristics - Part 6-35: Graphene-related products – Density: free-pouring, tapping and compressing method

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

Draft	Report on voting
113/900/DTS	113/910/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.

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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,
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INTRODUCTION

Graphene materials in powder form such as reduced graphene oxide and exfoliated graphite have high expectations for industrial applications including energy storage, composites, conductive ink, filtration membranes, etc. Graphenes available from commercial sources have a variety of shapes with various volumes per unit mass. The density of graphene materials affects both the surface area and the dispersion properties within a solvent matrix to fabricate their composites. Therefore, it is important that graphene manufacturers identify and provide information on the density of graphene materials to enable users to select a material suitable for their application.

Powder-type graphene sample has a very low density. Given its low mass per unit volume and its high fluffiness, it is difficult to directly apply the existing standard methods for evaluating the density of graphene samples, which have been used for the determination of powders containing heavy elements such as metals or ceramics. Therefore, it is essential to develop a new measurement method to evaluate the density of graphenes.

On the other hand, graphene has a very large volume per unit mass because of its low density, making its storage and distribution less efficient compared to other powder materials. This issue can be overcome by compressing graphene powder within a range that preserves its physical properties.

This document provides the method for evaluating the bulk densities of graphene, such as apparent density and tap density, and the compressed density of a sample compressed to a specific volume by applying a pressure. Furthermore, the evaluation method for the pressure required to reduce to a specific volume will be included. By measuring compressed density, it is possible to determine the pressure required to compress the graphene to a reducing volume for easy distribution and storage.

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1 Scope

This part of IEC TS 62607 establishes standardized methods to determine the structural key control characteristics

– apparent density (d_a),

– tap density (d_t), and

– compressed density (d_c)

for graphene in powder form by

– free-pouring, tapping and compressing method.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

3.1 General terms

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

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

– IEC Electropedia: available at https://www.electropedia.org/

– ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
nanomanufacturing
intentional synthesis, generation or control of nanomaterials, or fabrication steps in the nanoscale, for commercial purposes

[SOURCE: ISO/TS 80004-1:2015, 2.11]

3.1.2
blank detail specification
BDS
structured generic specification providing a comprehensive set of key control characteristics which are needed to describe a specific product without assigning specific values or attributes

Note 1 to entry: Examples of nano-enabled products are: nanocomposites and nano-subassemblies.

Note 2 to entry: Blank detail specifications are intended to be used by industrial users to prepare their detail specifications used in bilateral procurement contracts. A blank detail specification facilitates the comparison and benchmarking of different materials. Furthermore, a standardized format makes procurement more efficient and more error robust.

[SOURCE: IEC TS 62565-1:2023, 3.2]

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3.1.3
sectional blank detail specification
SBDS
specification based on a blank detail specification adapted for a subgroup of the nano-enabled product

Note 1 to entry: In general, the sectional blank detail specification contains a subset of those key control characteristics listed in the blank detail specification. In addition, sectional specific key control characteristics may be added if they are not listed in the blank detail specification.

Note 2 to entry: The templates defined in the sectional blank detail specification may contain key control characteristics with and without assigned values and attributes.

Note 3 to entry: The section can be defined by application, manufacturing method or general material properties.

3.1.4
detail specification
DS
specification based on a blank detail specification with assigned values and attributes

Note 1 to entry: The characteristics listed in the detail specification are usually a subset of the key control characteristics listed in the relevant blank detail specification. The industrial partners define only those characteristics which are required for the intended application.

Note 2 to entry: Detail specifications are defined by the industrial partners. Standards development organizations will be involved only if there is a general need for a detail specification in an industrial sector.

Note 3 to entry: The industrial partners may define additional key control characteristics if they are not listed in the blank detail specification.

[SOURCE: IEC TS 62565-1:2023, 3.3]

3.1.5
key control characteristic
KCC
key performance indicator
material property or intermediate product characteristic which can affect safety or compliance with regulations, fit, function, performance, quality, reliability or subsequent processing of the final product

Note 1 to entry: The measurement of a key control characteristic is described in a standardized measurement procedure with known accuracy and precision.

Note 2 to entry: It is possible to define more than one measurement method for a key control characteristic if the correlation of the results is well-defined and known.

[SOURCE: IEC TS 62565-1:2023, 3.1, modified – "material property or intermediate" has been added at the start of the definition.]

3.2 Terms related to general material description

3.2.1
graphene
graphene layer
single-layer graphene
monolayer graphene
single layer of carbon atoms with each atom bound to three neighbours in a honeycomb structure

Note 1 to entry: It is an important building block of many carbon nano-objects.
Note 2 to entry: As graphene is a single layer, it is also sometimes called monolayer graphene or single-layer graphene and abbreviated as 1LG to distinguish it from bilayer graphene (2LG) and few-layer graphene (FLG).
Note 3 to entry: Graphene has edges and can have defects and grain boundaries where the bonding is disrupted.

[SOURCE: ISO/TS 80004-13:2024, 3.1.2.1, modified – Note 4 to entry has been deleted.]

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