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TECHNICAL SPECIFICATION

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Nanomanufacturing – Key control characteristics – Part 2-6: Carbon nanotube-related products – Thermal diffusivity of vertically-aligned carbon nanotubes: flash method

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CONTENTS

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NANOMANUFACTURING – KEY CONTROL CHARACTERISTICS –

Part 2-6: Carbon nanotube-related products – Thermal diffusivity of vertically-aligned carbon nanotubes: flash method

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IEC TS 62607-2-6 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
113/823/DTS	113/845/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- withdrawn, or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.

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INTRODUCTION

Vertically-aligned carbon nanotubes (VACNTs) possess array structures, in which nanotubes are oriented in the perpendicular direction to a substrate surface. Chemical vapour deposition (CVD) is one of the common methods for the synthesis of VACNTs, where CNTs can be grown in the presence of metal catalysts, via thermal decomposition of hydrocarbon sources such as methane, ethylene, acetylene, ethanol, and so on. VACNTs are promising as thermal interface materials in electronics assembly owing to their high thermal conductivity, desirable mechanical properties, and good stability. Thermal transport properties in VACNT films really depend on their distribution and alignment behaviours of individual nanotubes, disorders such as defects and impurities.

Thermal diffusivity is one of the key parameters that govern thermal transport properties in solid materials. Flash method is a well-established, standard technique for measuring the thermal diffusivity. Originally, flash method was applicable to homogeneous monolithic (single layer) samples. In fact, some previous works reported thermal diffusivity measurements for self-standing VACNTs that were peeled off from the substrates after the CNT growth. However, VACNT films will be tightly connected to solid substrates in possible practical applications such as thermal interface materials. This means that flash method can not be simply applied to VACNT films grown on solid substrates. Hence, there is a need for new reliable protocols based on flash method for evaluating thermal diffusivity of VACNT films on solid substrates. This document specifies standardized protocols for measuring thermal diffusivity of VACNTs grown on solid substrates with flash method, where the specimen is a bilayer of the VACNT film and the substrate.

NANOMANUFACTURING – KEY CONTROL CHARACTERISTICS –

Part 2-6: Carbon nanotube-related products – Thermal diffusivity of vertically-aligned carbon nanotubes: flash method

1 Scope

This part of IEC 62607 specifies a protocol for determining the key control characteristic

- thermal diffusivity

for vertically-aligned carbon nanotube (VACNT) films grown on solid substrates by

- flash method.

A light pulse from a flash lamp or a laser is irradiated onto the front surface (substrate side) of the VACNT film on solid substrates. Then, the temperature change of the other side of the specimen is monitored in real time after the pulse irradiation. The thermal diffusivity of the VACNT film can be analysed from the time variation of this temperature change.

– This method is applicable for evaluating the thermal transport properties of the VACNT films that can be used as thermal interface materials in electronics assembly.

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 62607-2-5:2022, *Nanomanufacturing – Key control characteristics – Carbon nanotube materials – Mass density of vertically-aligned carbon nanotubes: X-ray absorption method*

ISO 18755:2022, *Fine ceramics (advanced ceramics, advanced technical ceramics) – Determination of thermal diffusivity of monolithic ceramics by flash method*