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Nanomanufacturing — Key Control Characteristics

Part 8-3: Nano-enabled metal-oxide interfacial devices — Analogue resistance change and resistance fluctuation: Electrical resistance measurement

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NANOMANUFACTURING – KEY CONTROL CHARACTERISTICS –

Part 8-3: Nano-enabled metal-oxide interfacial devices – Analogue resistance change and resistance fluctuation: Electrical resistance measurement

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IEC TS 62607-8-3 has been prepared by IEC technical committee 113: Nanotechnology standardization for electrical and electronic products and systems. It is a Technical Specification.

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

Draft	Report on voting
113/743/DTS	113/767/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.

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.

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.

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

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

Nano-enabled metal-oxide interfaces, such as an oxide nanolayer sandwiched by metal electrodes, are the essential components of IoT devices for computing. Nano-enabled functions derived from the nanoscale metal-oxide interface and the oxide nanolayer appear, such as a significant change in electrical resistance. The analogue resistance change is the typical characteristic which possesses the large potential for non-von Neumann information processing. More concretely, the metal-oxide interfacial device is an indispensable element in the product-sum circuit that records the learning process as the analogue resistance change. In the research community, however, the analogue change and the fluctuation of the resistance have not yet been systematically investigated. The reason why systematic research and development is not progressing is that the measurement protocol of these characteristics is not quantitative. The bottleneck impedes not only the electrotechnical evaluation of the device but also developments for various applications.

This document offers a measurement protocol of the analogue resistance change and the quantitative index to evaluate the linearity of the analogue resistance change in nano-enabled metal-oxide interfacial devices.

NANOMANUFACTURING – KEY CONTROL CHARACTERISTICS –

Part 8-3: Nano-enabled metal-oxide interfacial devices – Analogue resistance change and resistance fluctuation: Electrical resistance measurement

1 Scope

This part of IEC 62607, which is a Technical Specification, specifies a measurement protocol to determine the key control characteristics

– analogue resistance change, and

– resistance fluctuation

for nano-enabled metal-oxide interfacial devices by

– electrical resistance measurement.

Analogue resistance change as a function of applied voltage pulse is measured in metal-oxide interfacial devices. The linearity in the relationship of the variation of conductance and the pulse number is evaluated using the parameter fitting. The parameter of the resistance fluctuation is simultaneously computed in the fitting process.

– This method is applicable for evaluating computing devices composed of the metal-oxide interfacial device, for example, product-sum circuits, which record the learning process as the analogue resistance change.

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 80004-1, *Nanotechnologies – Vocabulary – Part 1: Core vocabulary*

3 Terms, definitions, acronyms, and abbreviated terms

3.1 Terms and definitions

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

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp