PD IEC/TS 62607-4-1:2015

BSI Standards Publication

Nanomanufacturing — Key control characteristics

Part 4-1: Cathode nanomaterials for nano-enabled electrical energy storage — Electrochemical characterisation, 2-electrode cell method

This Published Document is the UK implementation of IEC/TS 62607-4-1:2015. It supersedes PD IEC/TS 62607-4-1:2014, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee NTI/1, Nanotechnologies.

A list of organizations represented on this committee can be obtained on request to its secretary.

Published by BSI Standards Limited 2015

ISBN 978 0 580 89147 2
ICS 07.030

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This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 September 2015.

Amendments/corrigenda issued since publication

Date	Text affected

Edition 2.0 2015-08

TECHNICAL SPECIFICATION

colour inside

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 07.030

ISBN 978-2-8322-2852-4

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- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical Specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62607-4-1, which is a Technical Specification, has been prepared by IEC technical committee 113: Nanotechnology standardization for electrical and electronic products and systems.

This second edition cancels and replaces the first edition published in 2014. This edition constitutes a technical revision.

Following discussions between IEC TC 113 and IEC TC 21/SC 21A: Secondary cells and batteries containing alkaline or other non-acid electrolytes, this edition includes the following significant technical changes with respect to the previous edition:

a) The title of IEC 62607-4-1 has been modified.
b) The scope has been revised to clarify that this Technical Specification deals with a standardized method for the determination of electrochemical properties of cathode nanomaterials of, for example, lithium-ion batteries utilizing lithium iron phosphate.
c) In 3.1.1, the definition of "cathode nanomaterial" has been revised to be more specific.

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

Enquiry draft	Report on voting
113/238/DTS	113/261A/RVC

Full information on the voting for the approval of this Technical Specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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 publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The future utilization of renewable energy technologies depends significantly on the development of efficient systems for energy storage. Conventional approaches exist for the storage of electrical energy from stationary power plants, currently fuelled by many new ideas in conjunction with the emerging "Smart Grid". For future e-mobility for individual transportation there is only one attractive solution: a battery that can store enough energy to allow all-electric driving with a range of several hundred kilometres. The current solutions already on the market can only be regarded as temporary solutions. From today's perspective, lithium-ion batteries and their derivative innovative concepts are regarded as the most promising candidates. Electrodes made from nanoscale composites will play a key role in the future. Innovative materials will be developed and systematically optimized, which implies testing of a large number of different materials.

Characterization of the electrochemical properties of cathode nanomaterials used in electrical energy storage devices is important for their customized development. This part of IEC 62607 provides a standard methodology which can be used to characterize the electrochemical properties of new cathode nanomaterials that will be employed in electrical energy storage devices. Following this method will allow comparison of different types of cathode nanomaterial and comparison of the results of different research groups.

This part of IEC 62607 introduces a 2-electrode cell method for the electrochemical characterization of nano-enabled cathode materials for electrical energy storage devices.

This standardized method is intended for use in comparing the characteristics of cathode nanomaterials in the study stage, not for evaluating the electrode in end products.

The method is applicable to materials exhibiting function or performance only possible with nanotechnology, intentionally added to the active materials to measurably and significantly change the capacity of electrical energy storage devices.

In this context it is important to note that the percentage content of nanomaterial of the device in question has no direct relation to the applicability of this part of IEC 62607, because minute quantities of nanomaterial are frequently sufficient to improve the performance significantly.

The fraction of nanomaterials in electrodes, electrode coatings, separators or electrolyte is not of relevance for using this method.

NANOMANUFACTURING – KEY CONTROL CHARACTERISTICS –

Part 4-1: Cathode nanomaterials for nano-enabled electrical energy storage – Electrochemical characterisation, 2-electrode cell method

1 Scope

This part of IEC 62607 provides a standardized method for the determination of electrochemical properties of cathode nanomaterials of, for example, lithium-ion batteries utilizing lithium iron phosphate to enable customers to:

a) decide whether or not a cathode nanomaterial is usable, and

b) select a cathode nanomaterial suitable for their application.

This part of IEC 62607 includes:

– definitions of terminology used in this part of IEC 62607,

– recommendations for sample preparation,

– outlines of the experimental procedures used to measure cathode nanomaterial properties,

– methods of interpretation of results and discussion of data analysis, and

– case studies.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 terms*

3 Terms, definitions, acronyms and abbreviations

3.1 Terms and definitions

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

3.1.1
cathode nanomaterial
material used as a cathode in nano-enabled energy storage devices which contains a fraction of nanomaterial and exhibits function or performance made possible only with the application of nanotechnology

Note 1 to entry: The cathode is a multilayered foil consisting of (1) an aluminium current collector, (2) an optional adhesion promoting carbon layer (to enhance cathode layer adhesion if necessary) and (3) the cathode layer. This cathode layer consists of the active phase (e.g. lithium containing mixed oxides or phosphate, as LFP), a conducting phase (carbon black) and an organic binder (PVDF).

3.1.2
screw cell
cell providing the geometrical conditions in the 2-electrode arrangement