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Nanomanufacturing — Key control characteristics

Part 4-1 Cathode nanomaterials for lithium ion batteries — Electrochemical characterisation, 2-electrode cell method

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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NANOMANUFACTURING – KEY CONTROL CHARACTERISTICS –

Part 4-1 Cathode nanomaterials for lithium ion batteries – Electrochemical characterisation, 2-electrode cell method

FOREWORD

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- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- 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.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
113/173/DTS	113/192/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 of 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 web site 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- withdrawn,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 utilisation 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 must be 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 lithium ion batteries is important for their customized development. This IEC technical specification provides a standard methodology which can be used to characterize the electrochemical properties of new cathode nanomaterials that will be employed in lithium ion batteries. Following this method will allow comparison of different types of cathode nanomaterial and comparison of the results of different research groups.

A revised edition 2.0 is already under preparation to introduce changes proposed by IEC SC 21A. The future edition may e.g. include the following changes:

- The title will be amended: the term “lithium ion batteries" will be replaced by “nano-enabled electrical energy storage”.
- The scope will be revised to change the phrase "lithium ion battery" to e.g., "lithium ion batteries utilizing lithium iron phosphate".
- The definition of "electrode nanomaterials" will be revised to be more specific, reading e.g. "electrode containing a nanomaterial portion of more than xx% by weight".

NANOMANUFACTURING – KEY CONTROL CHARACTERISTICS –

Part 4-1 Cathode nanomaterials for lithium ion batteries – Electrochemical characterisation, 2-electrode cell method

1 Scope

This part of IEC 62607 provides a standardized method for the determination of electrochemical properties of lithium ion battery cathode nanomaterials 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 technical specification includes:

– definitions of terminology used in this document,

– 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,

– case studies and

– references.

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 core terms and definitions of ISO/TS 80004-1 and the following terms and definitions apply.

3.1.1
cathode nanomaterial
electrodes used as cathodes in lithium ion batteries

Note 1 to entry: The cathode nanomaterial is a foil with a multilayered layout, built up 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, such as LCO, NCA, NCM, and LFP), a conducting phase (carbon black) and an organic binder (PVDF).

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