

TECHNICAL SPECIFICATION

**Nanomanufacturing - Key control characteristics -
Part 4-11: Nano-enabled energy storage - Dispersion stability of nano-carbon
materials for the electrodes of lithium-ion capacitors: zeta potential method**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Nanomanufacturing - Key control characteristics -
Part 4-11: Nano-enabled energy storage - Dispersion stability of
nano-carbon materials for the electrodes of lithium-ion capacitors:
zeta potential method**

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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.

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INTRODUCTION

Zeta potential (ζ), a key parameter in colloidal dispersion systems, is defined as the potential difference between the slipping plane and dispersion medium. This potential reflects the interaction between charged particles in suspension and is directly influenced by the distance between the particle surface and the bulk fluid where the mobile phase interacts with the stationary fluid layer.

In industrial contexts, ζ serves as a critical measure for determining the stability of colloidal systems. Its utility extends across various sectors, such as pharmaceuticals, wastewater treatment, and food production, where the control of colloidal stability is essential for product performance. High ζ values typically indicate strong electrostatic repulsion between particles, minimizing aggregation and ensuring system stability. Conversely, low ζ values suggest a dominance of attractive forces, potentially leading to flocculation or coagulation.

Given its broad relevance, the method for measuring ζ has become indispensable in ensuring the quality and functionality of colloidal formulations. This document explores the principle of ζ and its measurement, while emphasizing its industrial applications and the associated requirements for different sectors.

1 Scope

This part of IEC 62607 specifies the dispersion stability by using the zeta potential (ζ) method for nano-carbon materials for lithium-ion capacitors. This document describes not only the dispersion stability of nano-carbon materials but also the effect of different surfactants as well as the evaluation method for testing long-term dispersion stability using ζ . This document describes:

- Dispersion stability of nano-carbon materials using ζ for lithium-ion capacitors using carbon nanomaterials as electrodes
- Effect of different surfactants
- Evaluation of long-term dispersion stability using the ζ method

2 Normative references

There are no normative references in this document.

3 Terms and definitions

3.1 General related terms

3.1.1

zeta potential

ζ

potential difference between the slipping plane and dispersion medium

3.1.2

dispersion

<in chemistry> system in which distributed particles of one material are dispersed in a continuous phase of another material

3.1.3

colloid

mixture in which one substance consisting of microscopically dispersed insoluble particles is suspended throughout another substance

3.1.4

nano-carbon materials

carbon nanomaterials

morphologically confined objects, generally formed in nanometre size either in zero, one, or two dimensions, which are made up of carbon atoms with conjugated π -electron systems at their surfaces

Note 1 to entry: Examples include fullerenes, carbon nanotubes, graphene, graphene oxide, carbon nanofibers, carbon blacks, and carbon onions, etc.

3.1.5

surfactant

compound that lowers the surface tension (or interfacial tension) between two liquids, between a gas and a liquid, or between a liquid and a solid

3.1.6

electric double-layer

EDL

spatial distribution of electric charges that appears on and at the vicinity of the surface of an object when it is placed in contact with a liquid