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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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CONTENTS

FOREWORD 3
INTRODUCTION 5
1 Scope 6
2 Normative references 6
3 Terms and definitions 6
3.1 General related terms 6
3.2 Key control characteristics measured according to this document 7
4 Measurement principle and sample preparation method 7
4.1 Measurement principle 7
4.2 Sample preparation method 9
4.2.1 Materials 9
4.2.2 Chemicals 10
4.2.3 Apparatus 10
4.2.4 Detailed sample preparation procedure 10
4.3 Measurement system 10
4.4 Description of measurement equipment / apparatus 11
4.5 Calibration standards 11
4.6 Ambient conditions during measurement 11
5 Measurement procedures – Detailed protocol 11
5.1 General 11
5.2 Minimum required measurement parameters 13
5.3 General measurement procedure for ζ 13
5.4 Size of particles 13
5.5 Minimal specifications of ζ measurement analyser 13
6 Results to be reported 13
6.1 General 13
6.2 Product/sample identification 14
6.3 Test conditions 14
6.4 Measurement-specific information 14
6.5 ζ and dispersion stability 14
Annex A (informative) Application, worked examples 15
A.1 Example 1 – Results 15
A.2 Example 2 – Results 17
A.3 Theory of ζ 26

Figure 1 – Pictorial visualization of factors associated with ζ 8
Figure 2 – Schematic of ζ measurement setup 10
Figure 3 – Mechanism of ζ analyser for electrophoresis 12
Figure A.1 – ζ distributions for single-walled carbon nanotubes (SWNTs) functionalized with different surfactants and their concentrations in deionized (DI) water solution 15
Figure A.2 – Histograms of average values of ζ distributions SWNTs that are shown in Figure A.1 16
Figure A.3 – Optical images for SWNTs that are shown in Figure A.1 17
Figure A.4 – Histograms of ζ values (in mV) for initially dispersed samples of SWNTs, graphene oxide, carbon black, and graphite in DI water and with various surfactants at different concentrations as shown in Table A.2 19

Figure A.5 – Histograms of ζ values for SWNTs, GO, carbon black, and graphite in DI water and with various surfactants at different concentrations, measured 5 days after initial dispersion 20

Figure A.6 – Histograms of ζ values for initially dispersed samples of SWNTs, GO, carbon black, and graphite in DI water and with various surfactants at different concentrations, with corresponding dispersion images 20

Figure A.7 – Histograms of ζ values for SWNTs, GO, carbon black, and graphite in DI water and with various surfactants at different concentrations, measured 5 days after initial dispersion, with corresponding dispersion images 21

Figure A.8 – Histograms of ζ values in different solvents for each nano-carbon material (SWNTs, GO, carbon black, and graphite) in initially dispersed samples, with corresponding dispersion images 22

Figure A.9 – Histograms of ζ values in different solvents for each nano-carbon material (SWNTs, GO, carbon black, and graphite) measured 5 days after initial dispersion, with corresponding dispersion images 23

Figure A.10 – Histograms of ζ changes over time for SWNT in different solvents, comparing initially dispersed samples with measurements taken 5 days later, with corresponding dispersion images 24

Figure A.11 – Histograms of ζ changes over time for GO in different solvents, comparing initially dispersed samples with measurements taken 5 days later, with corresponding dispersion images 25

Figure A.12 – Histograms of ζ changes over time for carbon black in different solvents, comparing initially dispersed samples with measurements taken 5 days later, with corresponding dispersion images 25

Figure A.13 – Histograms of ζ changes over time for graphite in different solvents, comparing initially dispersed samples with measurements taken 5 days later, with corresponding dispersion images 26

Figure A.14 – Plot showing the interatomic forces versus distance 27

Figure A.15 – Decrease of electrical repulsion with increasing ion concentration (C) 27

Figure A.16 – Steric and electrostatic stabilization mechanisms of colloidal dispersions 28

Figure A.17 – Schematic to represent inter-dependency between charged particles and ζ data 29

Table 1 – Stability establishment based on ζ values 9

Table A.1 – Average values of ζ and pH of SWNTs that are shown in Figure A.1 16

Table A.2 – pH values for initially dispersed samples of SWNTs, GO, carbon black, and graphite in DI water and with various surfactants at different concentrations 18

Table A.3 – ζ values for initially dispersed samples of SWNTs, GO, carbon black, and graphite in DI water and with various surfactants at different concentrations 18

Table A.4 – ζ values for SWNTs, GO, carbon black, and graphite in DI water and with various surfactants at different concentrations, measured 5 days after initial dispersion 19

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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