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Guidelines for good practices in zeta-potential measurement

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National foreword

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Guidelines for good practices in zeta-potential measurement

Lignes directrices relatives aux bonnes pratiques pour la mesure du potentiel zéta

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Symbols ... **1**
5 Principle ... **1**
6 Sample preparation ... **2**
6.1 General ... 2
6.2 Sampling and sample inspection ... 2
6.3 Sample dilution procedures ... 3
6.4 Sample stability test ... 3
7 Measurement uncertainty and sources of error ... **4**
7.1 General ... 4
7.2 Carryover contamination from previous samples ... 4
7.3 Inappropriate sample preparation procedures ... 4
7.4 Inappropriate samples for electrophoretic light scattering measurement ... 5
7.5 Inappropriate liquid medium ... 5
7.6 Incorrect entries of parameters by the operator ... 5
7.7 Air bubbles ... 6
7.8 Inappropriate theory for calculating zeta potential from the measured electrophoretic mobility ... 6
7.9 Carbon dioxide ... 6
7.10 Effect of the applied electric field on susceptible samples ... 6
Annex A (informative) **Zeta-potential measurement for particles in non-polar media** ... **8**
Bibliography ... **9**

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Foreword

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This document was prepared by Technical Committee ISO/TC 24, *Particle characterization including sieving*, Subcommittee SC 4, *Particle characterization*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Zeta-potential is often used to investigate the isoelectric point (IEP) and surface adsorption for particles in liquid media, and as an indicator in comparing different samples regarding electrostatic-dependent dispersion stability. Zeta-potential is not a directly measurable quantity, but is established using an appropriate theory. Furthermore, zeta-potential is not an intrinsic property of suspended particles; it depends on both particle and medium properties, and how they interact at the interface. Any variation in the liquid chemical and ionic composition affects this interfacial equilibrium and, consequently, zeta-potential. Therefore, sample preparation and measurement procedures can both affect the measurement result. Incorrect conclusions often result from artefacts in sample preparation and issues arising from measurement procedures, or incorrect application of theoretical models for calculating zeta-potential from measurement results.

This document provides general guidelines for sample preparation and measurement procedures for the determination of zeta-potential by optically-based electrophoretic mobility or electroacoustic methods.

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Guidelines for good practices in zeta-potential measurement

1 Scope

This document addresses the zeta-potential measurement operation for applications such as new product design, optimization of existing products, quality control during processing and/or during usage of the product. It does not provide a complete procedure for zeta-potential measurements. The instructions and key points addressed in this document are considered useful for performing zeta-potential measurements as specified in ISO 13099-1 and ISO 13099-2.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Symbols

μ electrophoretic mobility

ε_m relative permittivity of the medium

ζ electrokinetic potential, zeta-potential

η_0 medium viscosity

5 Principle

Zeta-potential (ζ) is the electric potential at a hypothetical shear plane that separates the mobile solvent from solvent molecules that associate with the particle surface. Zeta-potential is frequently used to predict the stability of a suspension or the adhesion of suspended particles onto macroscopic surfaces (e.g. cellulose fibres, membranes). This is because interaction between particles or between particles and surfaces or between particles and proteins is often governed by the ion distribution in the diffuse layer, which is closely related to zeta-potential. Whenever electrostatic forces dominate interactions between particles or between particles and surfaces, zeta-potential is the principal system parameter to evaluate these interactions[1]. Repulsion requires high surface charges of equal sign, whereas attraction occurs in the absence of surface charge or for oppositely charged or "patchy" surfaces containing both negative and positive domains. High zeta-potential absolute values cause strong repulsion between dispersed particles and, thus, favour the stabilization of colloidal suspensions. This effect is even more pronounced for thick double layers in low electrolyte content. In contrast, low zeta-potential absolute values (+ or −), zeta-potentials of opposite sign (polarity), or high electrolyte concentrations, can promote agglomeration. Hence, zeta-potential can be principally employed to predict the suspension stability, which is frequently determined as a function of the pH and/or the

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