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Guidelines for good practices in zeta-potential measurement

National foreword

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

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Guidelines for good practices in zeta-potential measurement

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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.

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_o	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