



Standard Guide for Measurement of Electrophoretic Mobility and Zeta Potential of Nanosized Biological Materials¹

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1. Scope

1.1 This guide deals with the measurement of mobility and zeta potential in systems containing biological material such as proteins, DNA, liposomes and other similar organic materials that possess particle sizes in the nanometer scale (<100 nm).

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

E1470 Test Method for Characterization of Proteins by Electrophoretic Mobility (Withdrawn 2014)³

E2456 Terminology Relating to Nanotechnology

2.2 ISO Standards:⁴

ISO 13099-1 Colloidal systems — Methods for zeta-potential determination — Part 1: Electroacoustic and electrokinetic phenomena

ISO 13099-2 Colloidal systems — Methods for zeta-potential determination — Part 2: Optical methods

ISO 13321 Particle Size Analysis — Photon Correlation Spectroscopy

3. Terminology

3.1 **Definitions**—Definitions of nanotechnology terms can be found in Terminology **E2456**.

¹ This guide is under the jurisdiction of ASTM Committee **E56** on Nanotechnology and is the direct responsibility of Subcommittee **E56.02** on Physical & Chemical Characterization.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, <http://www.iso.org>.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 **Brownian motion**—is the random movement of particles suspended in a fluid caused by external bombardment by dispersant atoms or molecules.

3.2.2 **dielectric constant**—the relative permittivity of a material for a frequency of zero is known as its dielectric constant (or static relative permittivity).

3.2.2.1 **Discussion**—Technically, it is the ratio of the amount of electrical energy stored in a material by an applied voltage, relative to that stored in a vacuum.

3.2.3 **electrophoretic mobility**—the motion of dispersed particles relative to a fluid under the influence of an electrical field (usually considered to be uniform).

3.2.4 **isoelectric point**—point of zero electrophoretic mobility.

3.2.5 **mobility**—see electrophoretic mobility.

3.2.6 **redox reaction**—a chemical reaction in which atoms have their oxidation number (oxidation state) changed.

3.2.7 **stability**—the tendency for a dispersion to remain in the same form for an appropriate timescale (for example, the experiment duration; on storage at 358K).

3.2.7.1 **Discussion**—In certain circumstances (for example water colloid flocculation) instability may be the desired property.

3.2.8 **van der Waals forces**—in broad terms the forces between particles or molecules.

3.2.8.1 **Discussion**—These forces tend to be attractive in nature (because such attractions lead to reduced energy in the system) unless specific steps are undertaken to prevent this attraction.

3.2.9 **zeta potential**—the potential difference between the dispersion medium and the stationary layer of fluid attached to the dispersed particle.

3.2.10 **zwitterionic**—a molecule with a positive and a negative electrical charge.

3.2.10.1 **Discussion**—Amino acids are the best known examples of zwitterions.

4. Summary of Practice

4.1 **Introduction**—It is not the intention of this guide to spend any significant time on the theory of zeta potential and