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Particle size analysis — Particle tracking analysis (PTA) method

Analyse granulométrique — Méthode d'analyse de suivi de particule (PTA)

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Foreword

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The committee responsible for this document is Technical Committee ISO/TC 24, *Particle characterization including sieving,* Subcommittee SC 4, *Particle characterization*.

Introduction

Regulatory, scientific and commercial requirements for nanomaterial characterization or characterization of particulate suspensions where particle sizing and counting is required provide a strong case for further development of techniques such as Particle Tracking Analysis (PTA), also known as Nanoparticle Tracking Analysis (NTA) [14]. Due to the fact that the term PTA covers a larger size range and is more generic[1)], the term PTA is used throughout this document to refer to NTA and PTA. For all aims and purposes, the term PTA also means NTA in this document.

PTA is based on measuring the diffusion movement of particles in a suspension by means of laser illumination, imaging of scattered light, particle identification and localization, and individual particle tracking[2)]. In this case, suspension is an even dispersion of particles, gas bubbles or other liquid droplets. The hydrodynamic diameter of the individual particles, droplets or bubbles is related to Brownian motion parameters via the Stokes–Einstein equation.

In recent years the academic community working in fields such as liposomes and other drug delivery vehicles, nanotoxicology, viruses, exosomes, protein aggregation, inkjet inks, pigment particles, cosmetics, foodstuffs, fuel additives and fine bubbles began using the PTA technology for characterization. An ASTM standard guide (E2834–12) [10] was developed to give guidance to the measurement of particle size distribution by means of Nanoparticle Tracking Analysis. The present document aims to broaden the scope of the specification and to introduce system tests for PTA operation.

This document outlines the theory and basic principles of the particle tracking analysis method along with its limitations and advantages. It also describes commonly used instrument configurations and measurement procedures as well as system qualifications and data reporting. One of the key aspects is the meaning of the data and its interpretation. It should be noted that the key measurand obtained from PTA measurement is the number-based particle size distribution where the size is taken to mean the hydrodynamic diameter (3.11) of the particles in the sample. This size can be different from other sizes obtained with different techniques such as dynamic light scattering [6] or electron microscopy [4].

1) NTA is the most recognised abbreviation for the technique described in this document. However the Particle Tracking Analysis (PTA) includes NTA in its size range of measurements.

2) For the purpose of this document “tracking” will mean “following in terms of particle x and y position” and the “track” will mean “the path of that particle defined by such x and y coordinates of each step”