

Advancing the global comparability of chemical and biological measurement standards and capabilities - Enabling measurements to be made with confidence

CCQM Workshop on Particle Metrology

25 to 27 October 2022

**Report from breakout group for topic 2
Particles suspended in water or other liquids
Paola Fisicaro**

Breakout session agenda

12:20	Welcome and any further instructions	Paola Fisicaro (LNE)
12:25	NMI/DI perspectives and activities: Measurands and Method Dependency: Can One Size Fit All for Particles Suspended in Liquid?	Victoria Coleman (NMIA)
12:40	Invited presentations (15 min each, with questions deferred to discussion at the end of the breakout session) Identification and Characterization of Environmental Micro- and Nanoparticles	Karin Mattsson (University of Gothenburg)
	Nanoparticle Measurements and Applications in Semiconductor Manufacturing Accurate Measurement of Particle Number Concentration in Liquid at NMIJ: With Applications for Biomedical and Cellular Analyses	Wei-En Fu (ITRI) Yuki Kuruma (NMIJ)
13:40	Break	
13:55	Discussion and formation of recommended actions	Paola Fisicaro (LNE)
14:40	Rejoin main session*	

* Participants from all three breakout rooms rejoin the main session

Application sectors and challenges

Wide range of application fields and end-user communities:

(not exhaustive list)

Environment: nanoparticles and nano/microplastics in water

- Particle size range up to 5 μm
- Low concentration
- Sampling issues
- Extraction of particles from the matrices without modification of the integrity of the particles
- Identification of microplastic

Semiconductor technology

- Particle size <5nm, with number distribution <10 particles/ml
- Composition of the material
- Reference material needed: size<20nm, concentration<10000 particles/ml

Biological matrices

- Wide particle size range (< 30 nm up to 10 μm)
- Extraction of particles from the matrices
- Particles with appropriate refractive index for biomedical analyses

Measurement gaps

Critical understanding of measurements

- Need for better definition of what is intended to be measured
- Need for choice of the appropriate measurement technique

Large number of measurands and each community may have defined its own methodology and instrumentation to measure it

Some standard methods exist but are sector depended

- Need for harmonisation and exchange between communities

No single method can cover large size and concentration ranges nor different particle composition

- Need for multiple technique approaches

Measurement gaps

Method dependency

- Different techniques measure different diameters
- Assumptions are made (e.g. sphericity)
- Definition of the best descriptor of the size and size distribution

Application to real samples

- Difficulty to transfer from “ideal situations” to “real samples”
- Standards have mainly monomodal particle size distribution, real samples can be polydisperse
- Need for development of sample preparation methods, extraction from real matrices, data evaluation tools adapted to real sample complexity

Need for reference methods and reference materials for characterisation of “small” particles (< 30 nm)

Need for reference methods for particle surface chemical characterisation

What the metrology community can do

- Provide guidance about the measurand and the appropriate methods, including uncertainty estimations
- Produce (certified) reference materials including non monodisperse ones, functionalised RMs, matrix RMs
- Support end-users with complex matrices
- Organise Interlaboratory comparisons

Recommendation

Create a Task Group on Particles within CCQM involving VAMAS with a focus on:

- Foster the communication between different communities
- Organisation of interlaboratory comparisons
- Harmonisation of protocols
- Provision of guidance on methodologies for sample preparation

Acknowledgements

Many thanks to the breakout session 2 speakers!

Thank you for your attention