

Technical Session 9
***“Developing standards for measuring
nanomaterial properties“***



Development of Measurement Standards

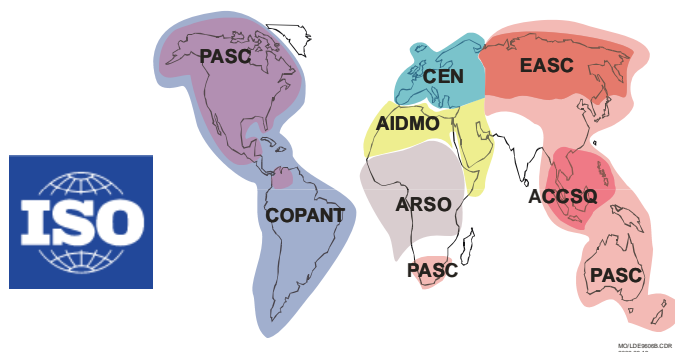
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Approach: **Standardisation**

“harmonized methods”



**prescribed
methods/procedures**

*sampling,
method-defined parameters*

Legislation

Approach: **Metrology**

“ultimate” analysis



Comité international des poids et mesures

Bureau
international
des poids
et mesures

Organisation
intergouvernementale
de la Convention
du Mètre

- Metrological traceability
- Measurement uncertainty



**prescribed
method-performance
characteristics**

*“structurally defined”
parameters*

⇒ **from documentary to ‘material’ standards**

Measurement
standard

Analytical
standard

Calibrant/
Calibrator



Standard
material

Reference
standard

Reference
substance

Laboratory
standard

RMs for:

Method development

Calibration

Method validation

- *evaluation of trueness*
- *uncertainty estimation*

Proof of method performance

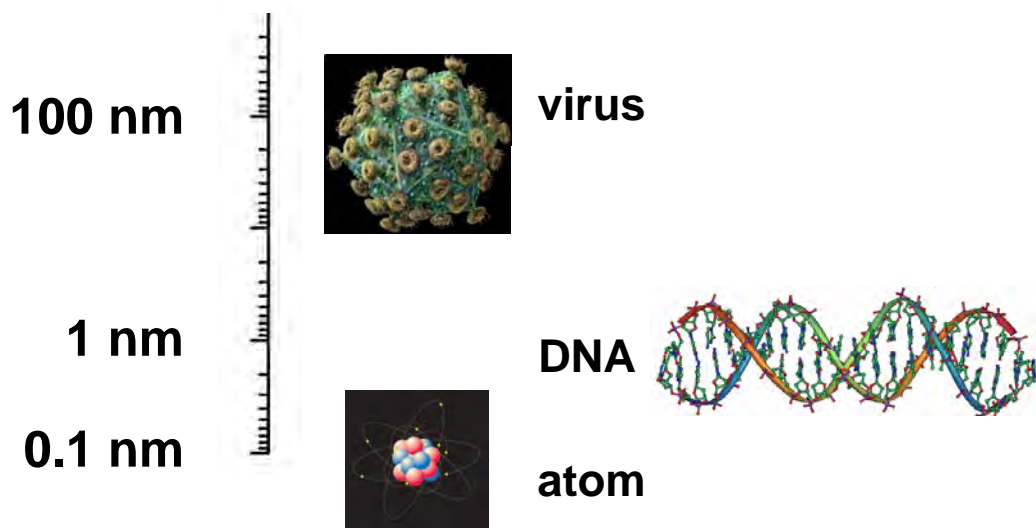
- *lab-internal quality control ('charting')*
- *operator or equipment qualification*

Proficiency testing

- *training and verification of competence (external benchmarking)*



- **exciting instrumental developments** (SPM, laser spectroscopies,...)
- **interesting research approaches to measure ‘model systems’**
- **few sufficiently defined measurands known**
- **almost no EHS-relevant measurement systems existing**



*“You may think you know a subject,
but until you can measure it
and calculate it your knowledge is
of a vague and unsatisfactory kind.”*

Ernest Rutherford (1871-1937)

(Relevant) characteristics according to ISO/TC 229:

What do the particles look like?

Size

Shape

What are the particles made of?

Bulk composition

Surface composition

Impurities

How do the particles interact with their environment?

Surface charge

Aggregation and agglomeration state

What are the relevant dynamic characteristics?

Degree of agglomeration

etc.

NNI EHS Research: Category “Instrumentation, Metrology, and Analytical Methods”

Are they complete?

**Observation: - presently very ‘static’ and ‘physics/mechanical’ oriented
- focus on “mass” as major quantity (not ‘reactivity-relevant’)**

Not sufficiently addressed issues:

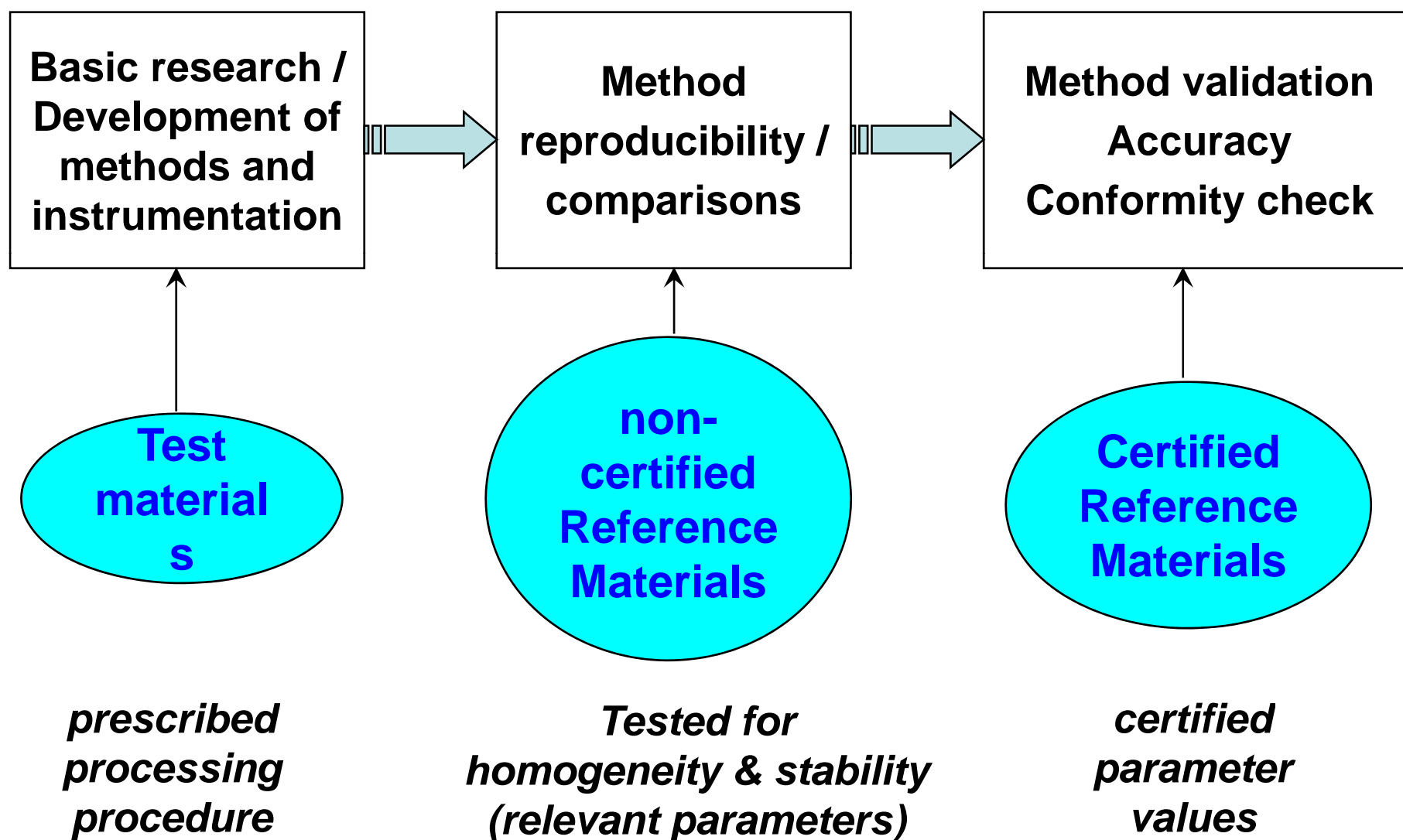
What to measure in condensed phases (water, biological media)?

How to sample without target transformations (information loss)?

Which morphology parameters matter and how to measure them?

How to measure the dynamics of nanomaterials under real-world conditions?

How to pre-characterize and to ensure the homogeneity and stability of different types of test/reference materials?



Category “Instrumentation, Metrology & Analytical methods”

- Near-term:** Identify the most relevant EHS ‘nano-related’ measurands in biological/environmental systems
- Develop harmonized protocols and method validation concepts for measuring related functional properties
- Mid-term:** Develop and certify a number of selected crucial reference materials for calibration, method validation and QC of nano-related functional property measurements
- Long-term:** Establish sustainable metrological traceability anchor points for such measurements

2. Progress with nomination and prioritisation of candidate materials

REFNANO (2007)

Carbon Black
Zinc oxide
Titanium dioxide
SWCNT
MWCNT
Polystyrene
Silver
Metals (Zn, Ni, Cu, Fe & their oxides)
Combustion-derived NPs

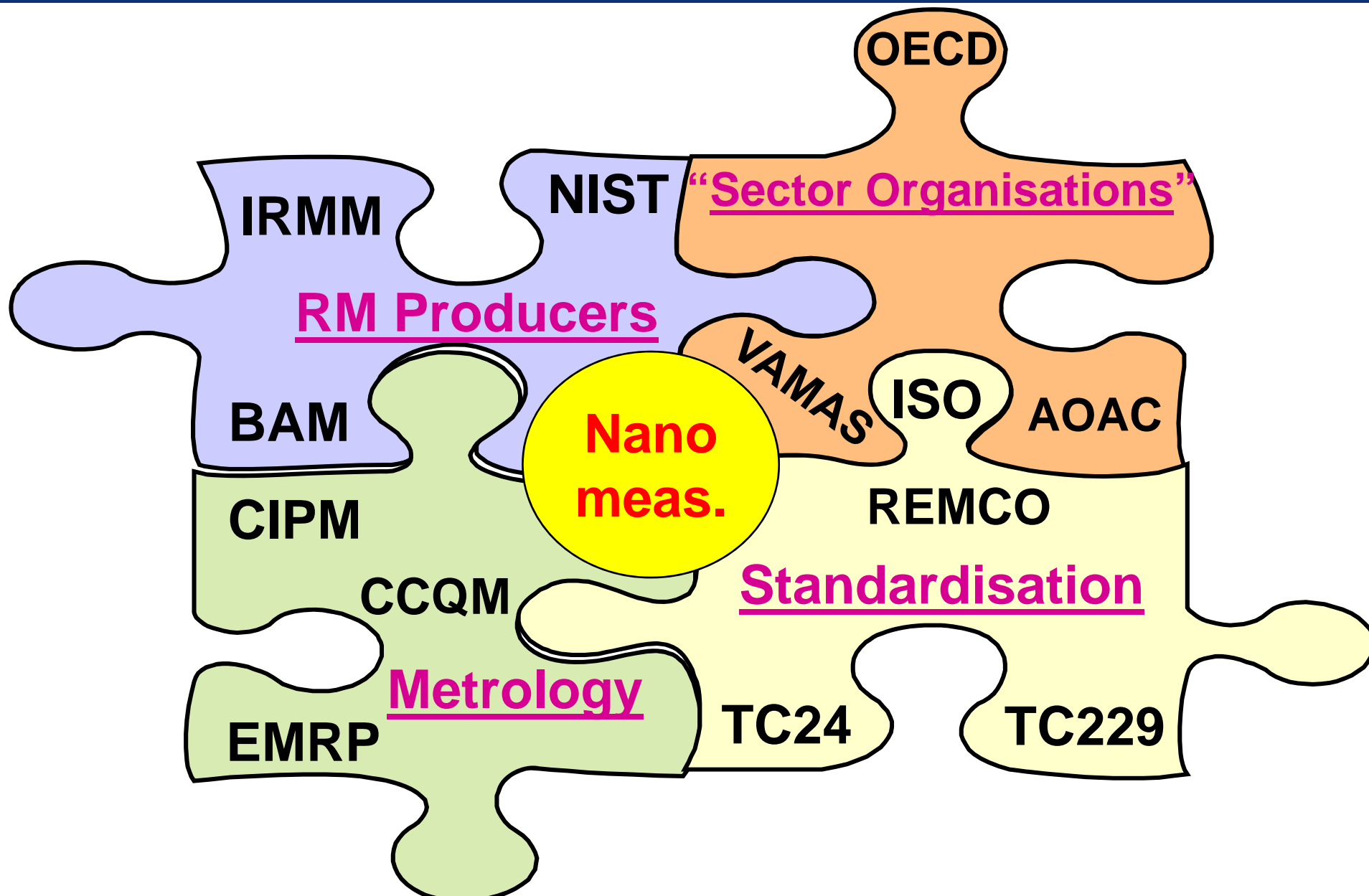
OECD (2008)

Fullerenes
SWCNT
MWCNT
Silver
Iron
Carbon Black
Titanium dioxide
Aluminium oxide
Cerium oxide
Zinc oxide
Silicon dioxide
Polystyrene
Dendrimers
Nanoclays

NanoImpactNet (2009)

Titanium dioxide
Silver
Polystyrene
Gold

from S. Hankin: Presentation at
the Workshop on Enabling
Standards for Nanomaterial
Characterization, NIST, 8-9 Oct.
2008



Workshop arranged by Co-Nanomet (EU project)
“Instruments, standard methods and reference materials for traceable nanoparticle characterisation”
May 3-4, 2010, Nuernberg (Germany)