Development of standards for Nanomaterial Description

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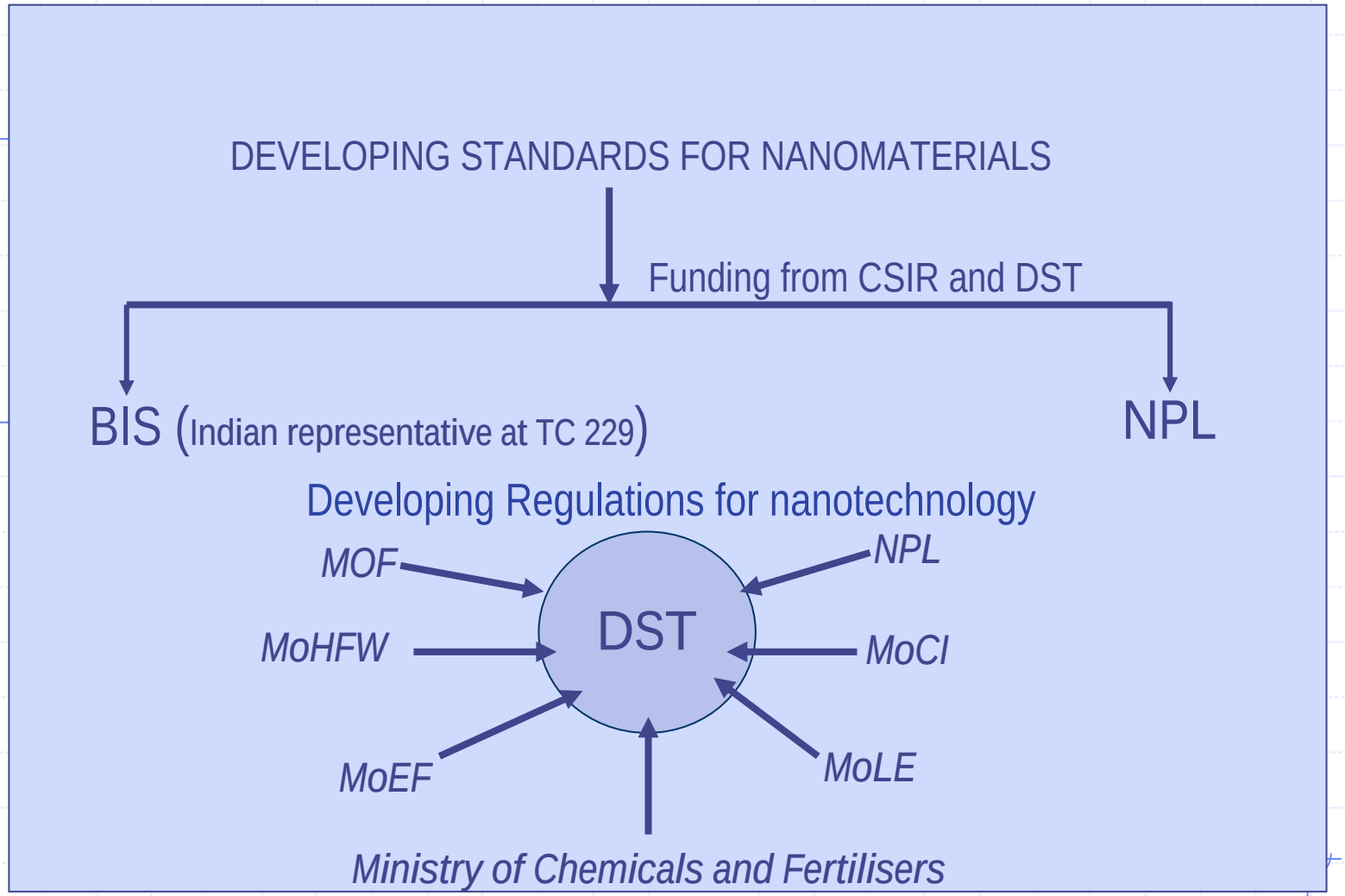
Dr. Renu Pasricha
National Physical Laboratory (India)
Council of Scientific and Industrial Research


DEVELOPING STANDARDS FOR NANOMATERIALS
Funding from CSIR and DST
BIS (Indian representative at TC 229)
NPL
Developing Regulations for nanotechnology
MOF
NPL
DST
MoHFW
MoCI
MoEF
MoLE
Ministry of Chemicals and Fertilisers

Nanotechnolgy strides in India

- Standards play a critical role in the advancement of science, technology, human health and global economy.

- Regulations specific to nanotechnology are being developed by Department of Science and Technology (DST), India in association with other agencies.

- DST launched a national Nano Science and Technology Initiative (NSTI) in 2001, which evolved into the “Nano Mission” in 2007.

- Bureau of Indian Standards (BIS) is the Indian member to ISO TC 229 .

- Strides have been taken by the BIS in collaboration with National Physical Laboratory (NPL), India, to make national standards for nanotechnologies.

National Physical Laboratory, India

- By an act of Parliament, NPL has the mandate to maintain and upgrade the *National Standards* of measurements of all physical variables except ionizing radiation.

Recently NPL has started standards related, in-house research in - materials, chemicals, and environmental sciences and also standardization and intercomparison with global partners

- NPL is the lead institution for developing and maintaining the standards for nanotechnology in India.

Mirror group (MTD 33)

For the harmonization of Indian Standards with the corresponding International Standards in the field of nanotechnologies.

BIS has established a mirror group (MTD 33 Chairman : Prof R.C. Budhani, Director NPL) to support international standardisation in nanotechnologies. *The Committee comprises of members from national labs, IIT's, IISc, Defense, Universities and Industries.* It has four working groups for:

- Terminology and Nomenclature
- Measurements and Characterisation
- Health, Safety, and Environment
- Materials Specification

The Bureau of Indian Standards (BIS) is also planning to fund toxicology studies on various nanomaterials including titanium dioxide, zinc oxide, silver and carbon nanotubes.

A step towards developing standards at NPL:

Standardization for Nanoscience and Technology (DST funded project)

Major Objectives are:

- To create a mechanism for nanomaterials standardization
- To create awareness in India about the importance of standardization in nanotechnology

The project has three planned areas:

I. Standardization of Magnetic State
II. Standardization of Size
III. Characterization and standardization of optical properties of nanomaterials

I. Standardization of Magnetic State

- Focus on only two magnetic nanoparticle systems namely Cobalt and Fe_2O_3.
- The nanoparticles will be standardized by their magnetic states, which will be described by:

- absolute saturation magnetization
- magnetic anisotropy
- blocking temperature

for an ensemble as well as for nanoparticles as a single entity.

Applications: Basic science,
Drug delivery, hyperthermia, Imaging

II. Standardization of Size

Size is universally applicable to all nanomaterials and is the most suitable measurand.

- The dimensions of the nanoparticles will be standardized through metrology grade (Scanning Probe Microscope) SPM system.
- Using standards of 1D, 2D gratings, step heights and standards particle size traceable to the SI unit.
- To be counterchecked using complementary standardized methods.

III. Characterization and standardization of Optical properties

The focus here will be on nanoparticles of ZnS and ZnO(pure and doped) .

Applications:

- Measurement of quantum efficiency
- Medical application: Might be used in treatment of oral cancer using photodynamic therapy (PDT), Antibacterial activity.

- Important properties for characterizing such nanomaterials will be:

  - Size
    - *Lower limit*
    - *Upper limit*
    - *Particle size distribution (external and internal nanostructures)*
  - Shape
  - Atomic structure.
  - Zeta potential (surface charge): In case of medical application
  - Surface chemistry (e.g. coating or modification)
  - Agglomeration/aggregation state
  - Crystalline phase
  - Toxicology
  - Water solubility
  - Optical properties

Thank You