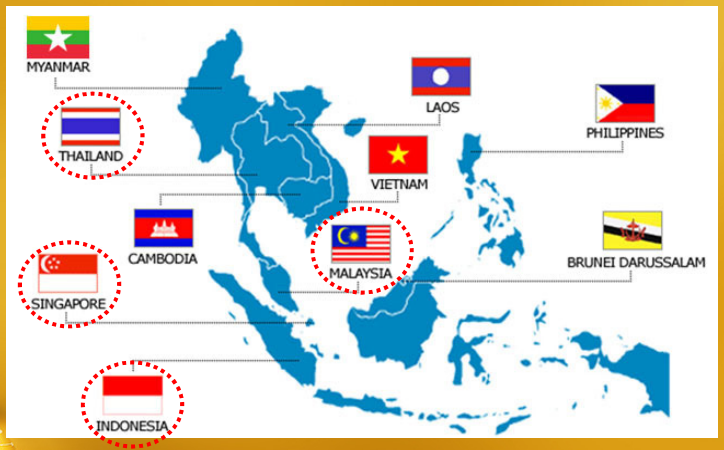
มาตรวิทยานาโนในประเทศไทย และกลุ่มประเทศสมาชิก AEC

ดร.จริยา บัวเจริญ
สถาบันมาตรวิทยาแห่งชาติ

กลุ่มประเทศสมาชิก AEC



Singapore (NMC, A*Star)

- Member of ISO/TC229
- 4 joint working groups for ISO/TC229 in Singapore
  - JWG1: Terminology and nomenclature
  - JWG2: Measurement and characterization
  - JWG3: Health, safety and environment
  - JWG4: Materials specifications.

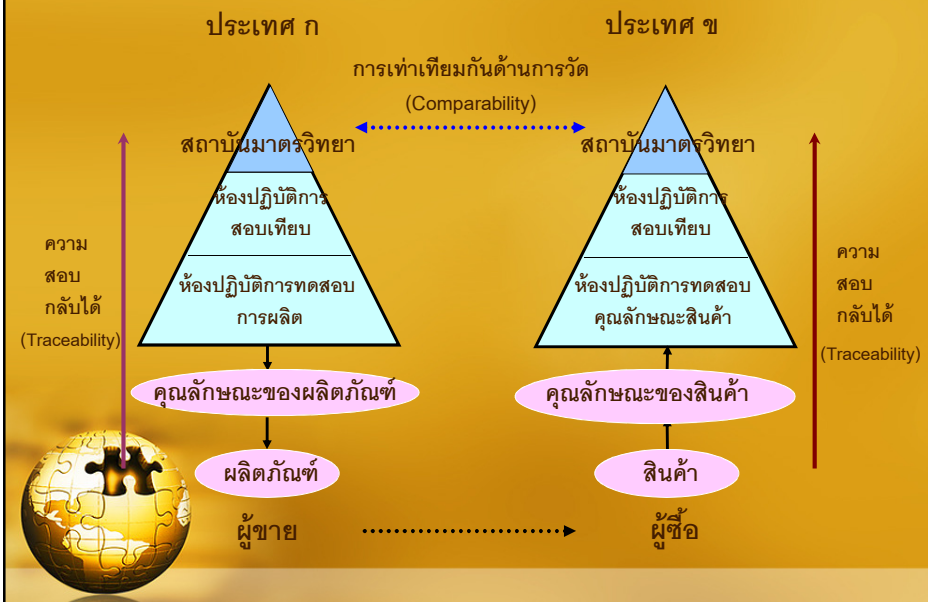
Activities in JWG 2

- Reviewing related international standards for measuring & characterization of nano-scale materials' properties, which are related to nano-scale dimensions such as nano-particle & pitch standards.
- Routine reviewing/voting for standard documents, commenting on measurement tools (SEM, AFM, X-ray based equipment and etc) in different applications and pitch standards to be measured by AFM/SEM
- In overall, playing a responding role for developing ISO in nanotechnologies.

Malaysia (SIRIM)

- Manufacturing medical nano devices such as biosensors for diagnostic applications
- Utilising nanopartides for imaging applications and targeted drug delivery
- Design and synthesis of functional inorganic nanoparticles, such as
  - nano silver
  - gold
  - titania
  - cobalt
  - superpararnagnetic Fe304
  - silica

Traceability



Asia Pacific (APMP)

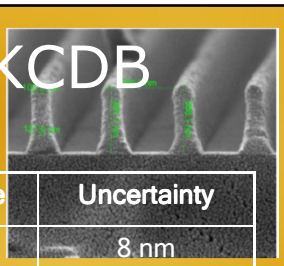
- All TCs are interested in nanotechnology but no TC is responsible for it. Nano size measurement using microscopes is a typical application, thickness, linewidth, pitch, etc.
- The most typical industrial application recently is nano particle. Not so many international comparisons have been performed, and not so many CMCs are registered in KCDB.
- Some international comparisons have been conducted but their reports were seldom published. Different measurement techniques delivered drastically different results, which is called 'Method divergence'.

CMC registered in KCDB

- Nano-particles

- Only Taiwan (CMS)
- Particles size standards. Polystyrene spheres, 20 nm to 1000 nm
- Absolute expanded uncertainty (k = 2.57, level of confidence 95%) in nm: 4.5
- Dynamic light scattering
- Approved on 20 October 2011

CMC registered in KCDB



- Step height standard

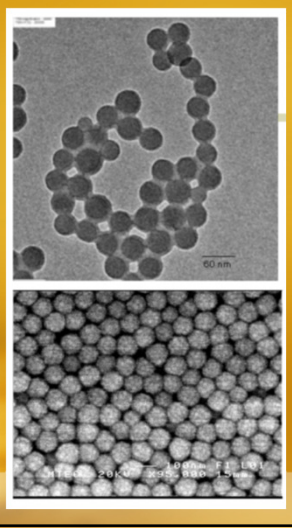
Country	Min. range	Max. range	Uncertainty
Japan	0.02 um	10 um	8 nm
China	0.1 um	40 um	9 nm
Taiwan	0.01 um	100 um	3 nm
Korea	0.3 um	30 um	12 nm
Singapore	0.005 um	5 um	1.5 um
Germany	0.001 um	10 um	1 nm
UK	0.0013 um	10 um	1.3 nm
USA	0.007 um	25 um	1 nm
Thailand	0.01 nm	32 um	2.4 nm

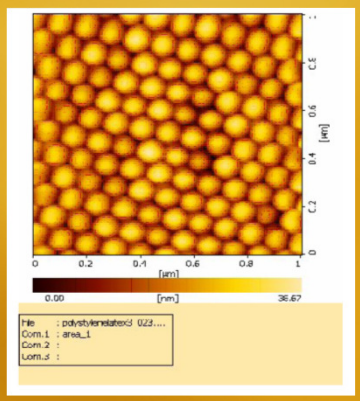
Thailand

- Standard Development
  - Thai Industrial Standards Institute [TISI]
- Nanomaterial Characterization
  - National Science and Technology Development Agency [NSTDA]
- Metrology
  - National Institute of Metrology (Thailand) [NIMT]

APEC ISTWG project

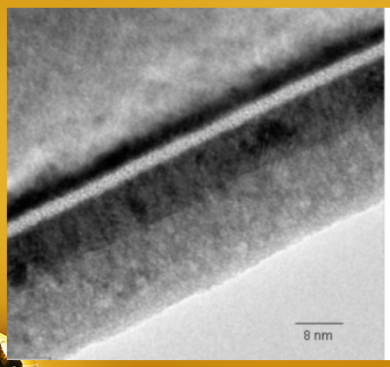
- Interlaboratory Comparison on Nanoparticle size Characterization 2006





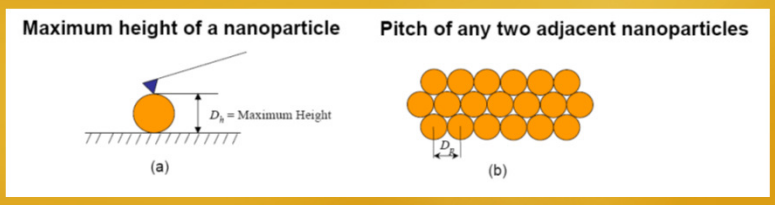
APEC ISTWG project

- Interlaboratory Comparison on Thin Film Thickness Characterization 2007



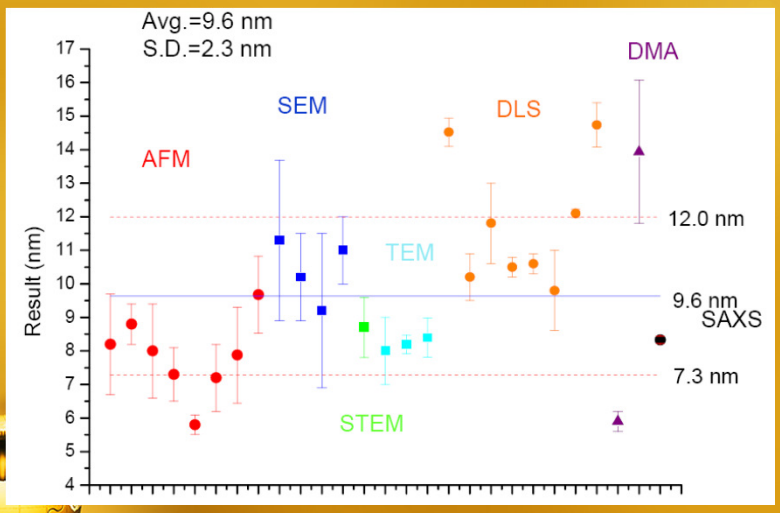
APMP.L-S5 Comparison

- Supplementary Comparison on Nanoparticle Size 2012
  - AFM

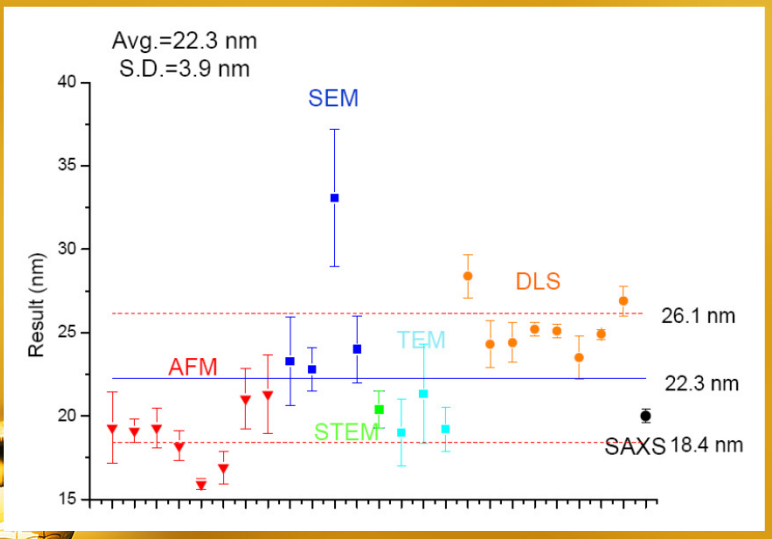


  - SEM
  - DLS

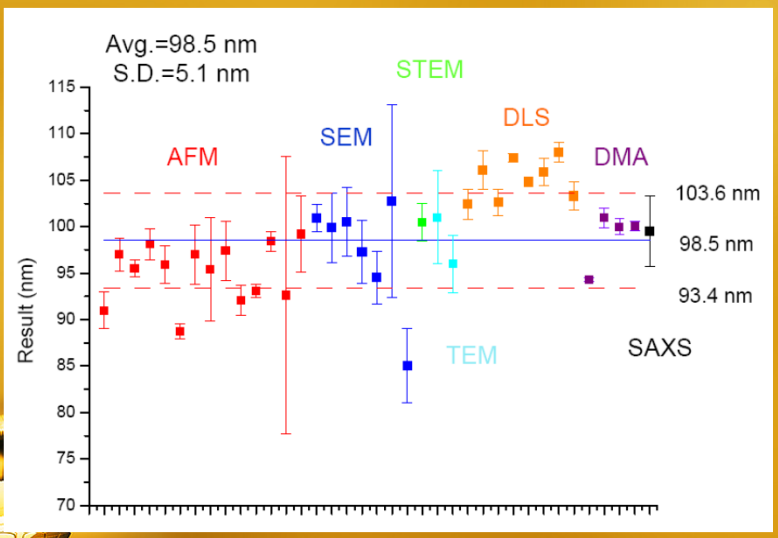
10 nm gold particle



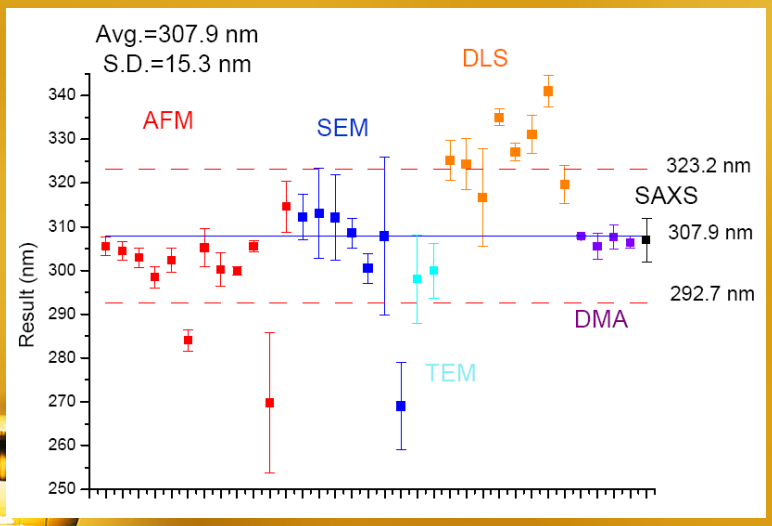
20 nm silver particle



100 nm PSL particle

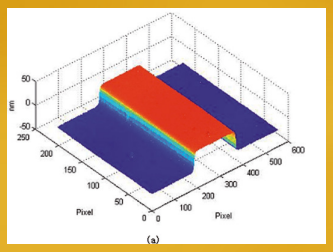


300 nm PSL particle



Traceability

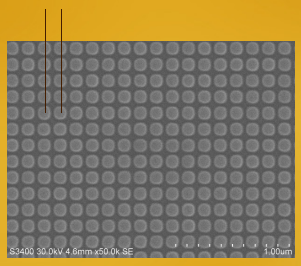
- Step height standard

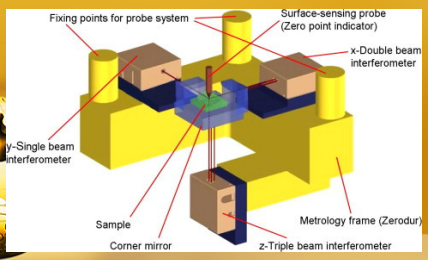


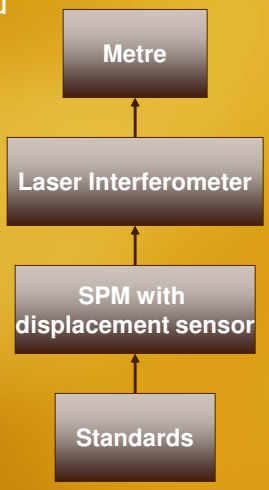
- Laser: Primary standard
  - the length of the path traveled by light in vacuum during a time interval of 1/299,792,458 of a second.

Future plan

- Traceability for pitch standard







Thank you for your attention