EUROPEAN COMMISSION

NanoSafety Cluster

Working group 1 Materials

Bruxelles, 10th december 2014

Sergio E. Moya

Within the cluster structure

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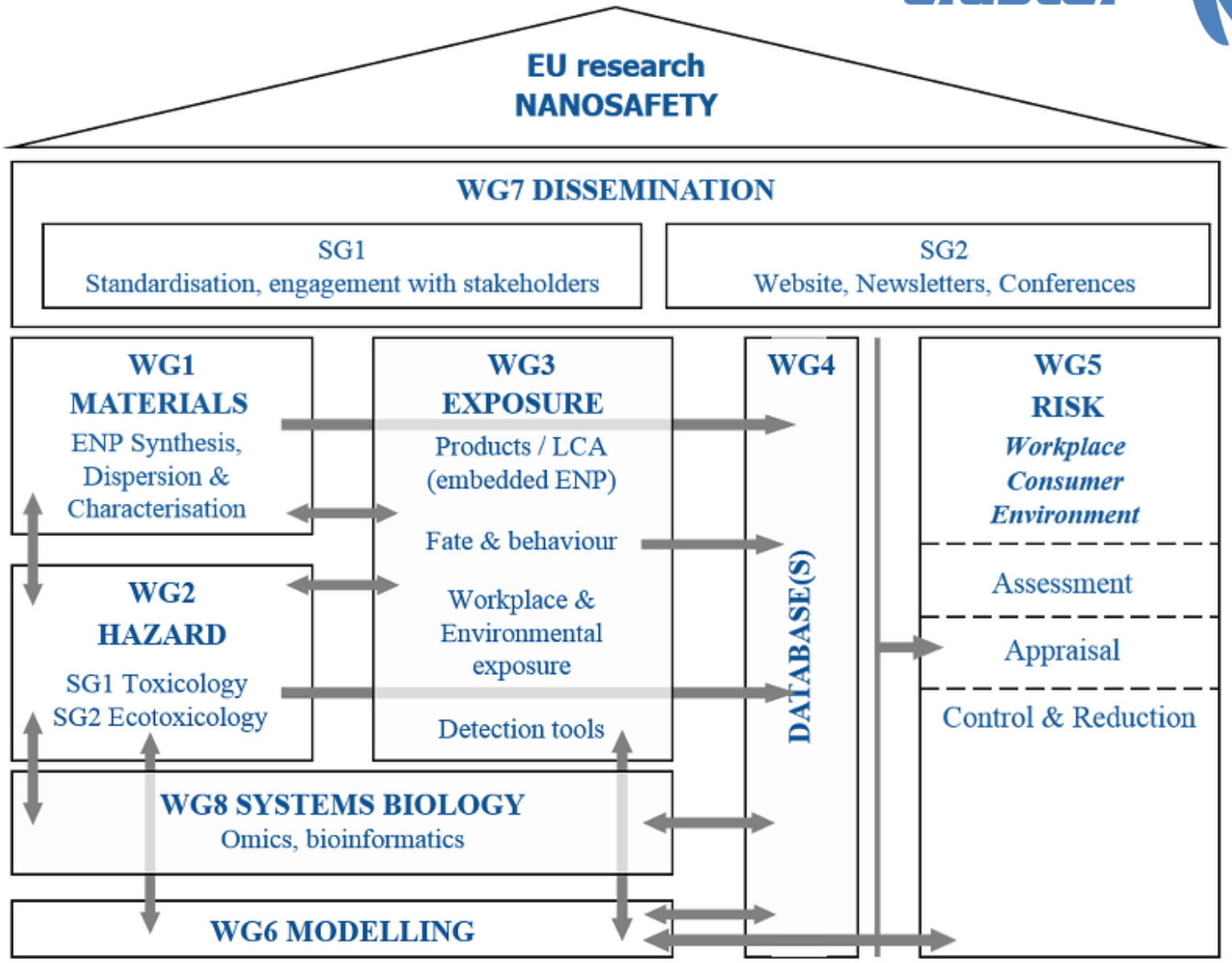

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Objectives

- Identify new developments in nanotechnology and nanosciences that are interest for the nanosafety comunity
- Identify physical properties of nanomaterials relevant for toxicological assesment.
- Identify standard/reference materials/methods for toxicological tests
- Identify and compare Standar Operating Procedures for nanomaterial characterization/dispersion methods

Nanomaterials

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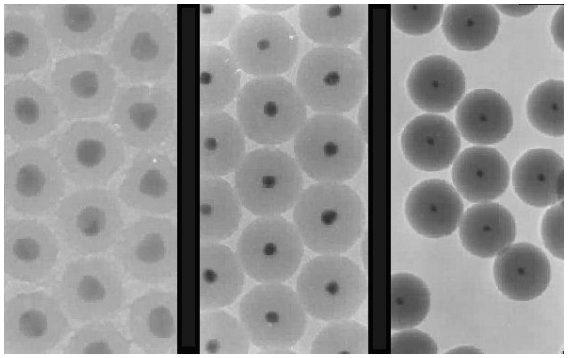
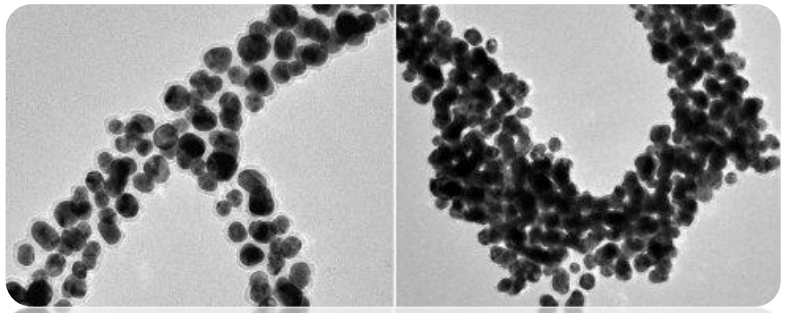
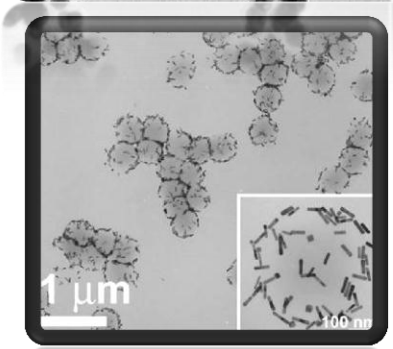
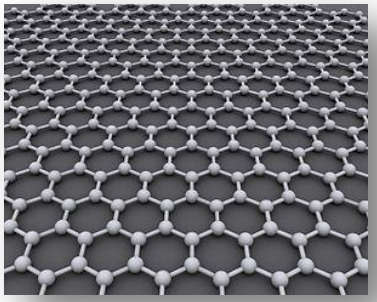
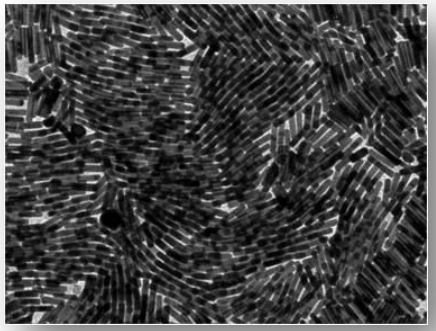
- Identify developments in material science with relevance for the Nanotox Comunity: graphene, hybrid Nanomaterial, hierachical assemblies, etc
- New materials may pose new challenges for dispersion, characterization, handling in toxicological work











Composite Materials

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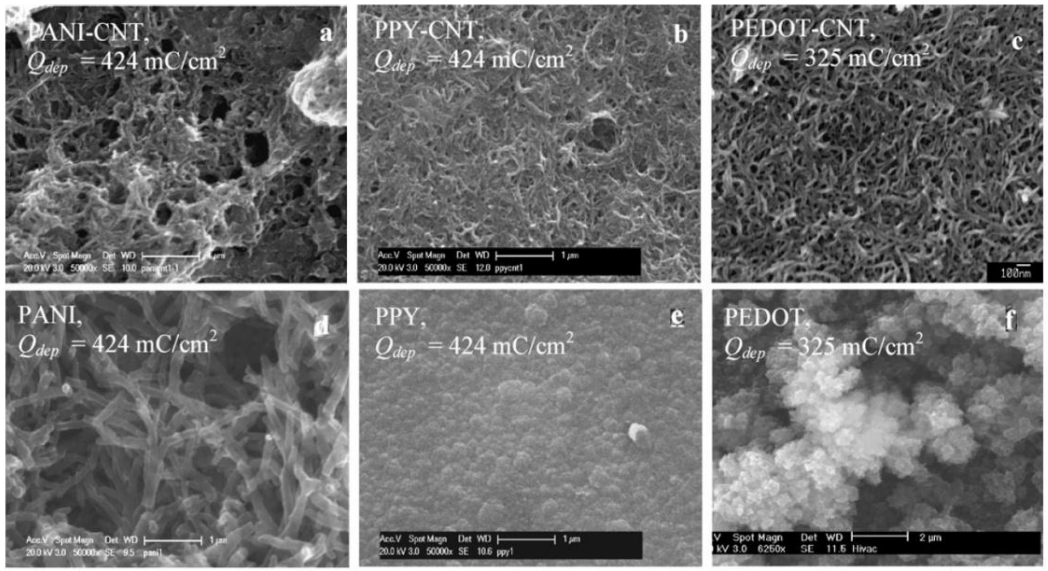

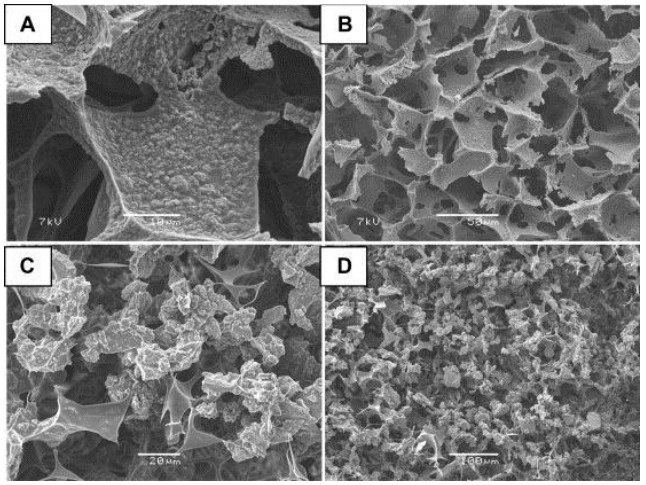

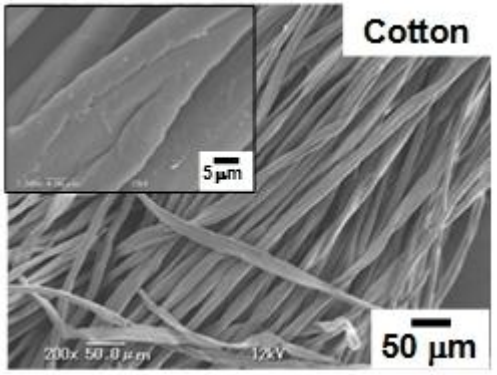

Nanomaterials in complex mixtures: polymers, fibers, coatings, construction material

Applications in multiple industries: textil, constructions, electronics, biomedical, etc

Understand materials along their life cycle: from fabrication to end of life

Reference materials

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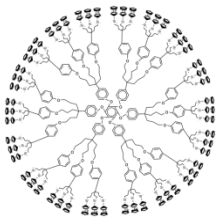
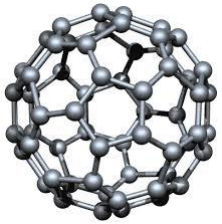
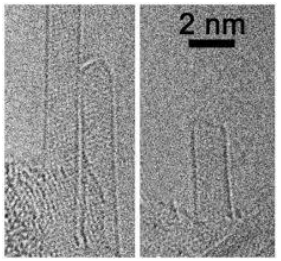
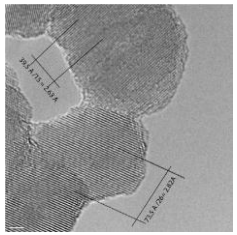
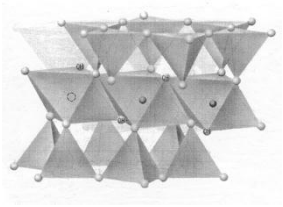
NIST (2007)[1]	REFNANO (2008)[2]	OECD (2010)[3]	NanoImpactNet (2010)[4]
Dendrimers	Carbon black	AlO_2	Polystyrene
Fullerenes	Cu-, Fe-oxides (combustion)	CeO_2	Ag
Ag	MWCNT	Dendrimers	TiO_2
Ce-, Fe-oxides (isotope labelled)	Polystyrene	Fullerenes	Cu/CuO, Fe
(combustion) MWCNT	Ag		Au
Fullerenes			
Quantum dots	SWCNT	Fe	Ag
SiO_2	TiO_2	MWCNT	SiO_2
Ag	ZnO	Nanoclays	
SWCNT	Au	SiO2	
TiO_2	CeO_2	Ag	
	SiO_2	SWCNT	
	Ceramics (rods, cubes, horns)	TiO_2	
	Nanoclays (isotope labelled)	ZnO	



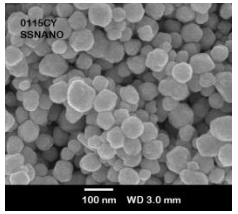








Different selection criteria: nanomaterial availability, Physico-chemical properties, composition economical/industrial importance, ecotoxity



Reference materials

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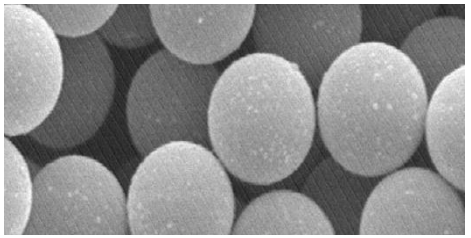
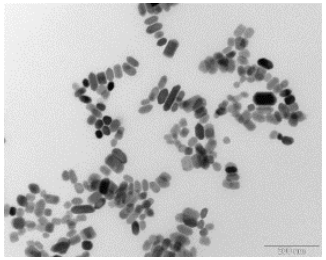
NanoValid (2011)[5]	MARINA (2011)[6]	NANoREG (2013)[7]	NanoDefine (2013)[8]
CuO	TiO_2	TiO_2	Pigment yellow 83
Fullerenes	SiO_2	ZnO	nanosteel
Au	ZnO	SiO_2	MWCNT
MWCNT	MWCNT	CeO_2	CaCO3
Pd		$BaSO_4$	ZnO, In_2O_3, FeO_2@SiO_2 (isotope labelled)
SiO2		Ag	TiO_2
Ag		MWCNT	ZnO
SWCNT		SWCNT	SiO_2
TiO2			Polystyrene
ZnO			
$Ca_3(PO_4)_2$			
PbS			
Ceramics			
Dendrimers			
Nanocellulose			
Nanoclays			
Q-dots (CdSe, CdS, CeO2)			
Polystyrene			

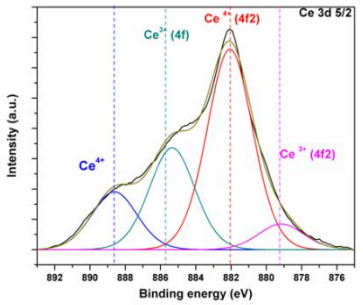




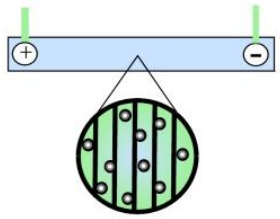
Different selection criteria: nanomaterial availability, economical/industrial importance, ecotoxity

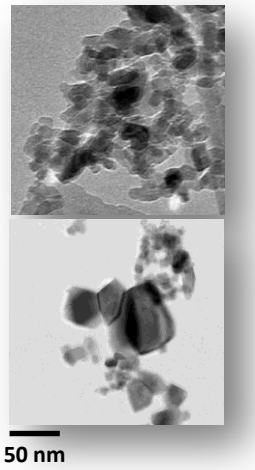
Physico chemical properties relevant to toxicology

Property	Frequency % (out of 28 studies)
Surface area (specific)	100
Elemental composition	96
Surface chemistry	89
Particle size	89
Particle size distribution	89
Morphology/shape/form	86
Surface charge	86
Agglomeration/aggregation state	71
Crystal structure	61
Surface reactivity	57



$$\mu = \zeta \varepsilon / \eta$$





Not all physical parameters are equally relevant to all nanomaterials
Some properties are relevant to the media
Some characterization/techniques are relevant to specific nanomaterials

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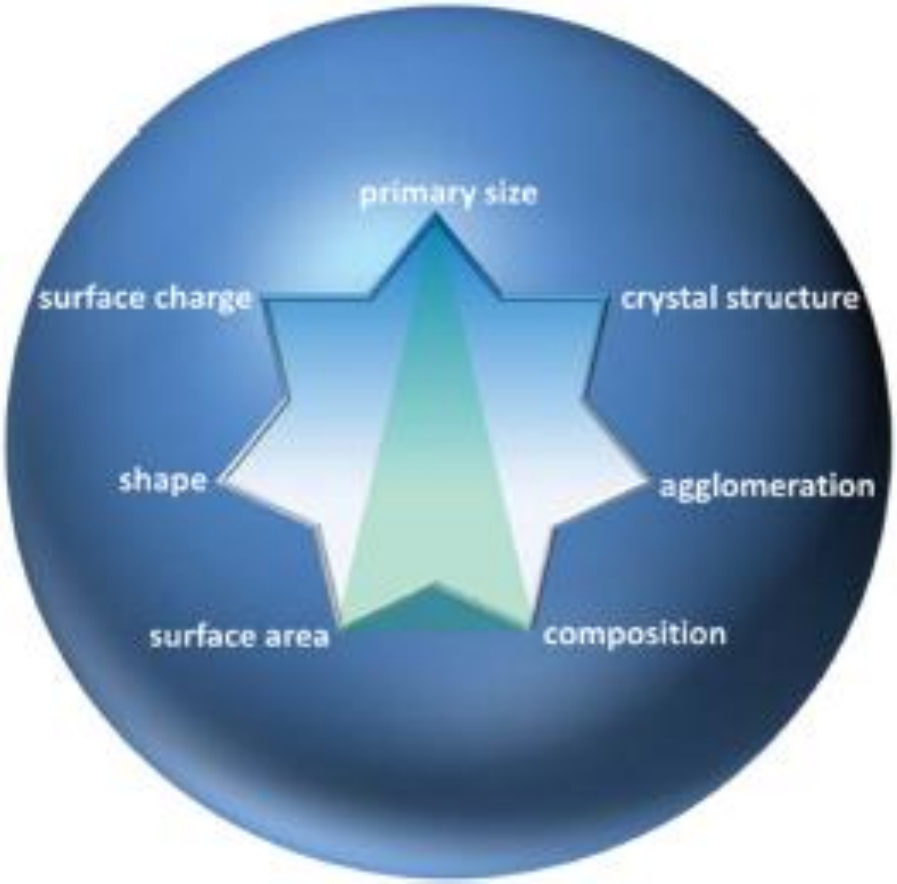

Some properties of NPs suggested as priority for toxicological studies.
Triangle: possible traceable properties of a multi-parametric reference material for nanotoxicology (Orts-Gill et al., 2013).

Physico chemical characterization/protocols

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OECD parameters	Experimental technique	Properties	Status
Porosity, Specific surface area	BET	Surface area, porosity	Protocol/SOP under validation
Crystalline phase, Crystallite size	XRD	Chemical composition, Crystal phase	Methods have been developed
Agglomeration/aggregation	DLS	Hydrodynamic diameter	Methods are being developed
Zeta potential	Zeta Potential	Surface charge, electrophoretic mobility, aggregation	Methods are being developed

- Need to follow common procedures and metrics
- Protocols may depend on materials

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On going work

On going analysis and discussions on reference materials/ characterization SOPs

Reference materials and methods are being validated and compared within the cluster

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Research priorities and road map

2015 Reference methods and biointeractions

2020 Data sets on reference ENM

2025 Key metrics for harmful impact