Nanomaterials in the Construction Industry

Background information on Nanotechnologies

Sectoral Social Dialogue Committee on Construction

Brussels 13 March 2008

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IVAM UvA BV Amsterdam

NanoCap

Acronym:

Nanotechnology Capacity Building NGO's

Granted by:

Directorate General Research
European FP6 programme Science and Society

Developed and coordinated by:

IVAM UvA BV
Research and Consultancy on Sustainability
Department of Chemical Risks

NanoCap

NanoCap

Discuss and deepen the understanding of NGOs and trade unions on nanotechnology on

- Environmental issues
- Occupational health and safety issues
- Ethical issues
- Critical assessment of benefits

Period

Sept 2006 – August 2009

Partners NanoCap

Coordination: NL - IVAM

Trade Unions

- EU - ETUI-REHS
- NL – FNV
- DE – KOOP (→DGB)
- AT – ppm (→ ÖGB)
- IR - Amicus

Environmental NGOs

- EU – EEB
- NL – N&M
- IT – Legambiente
- GR – MIO-ECSDE
- LT - BEF

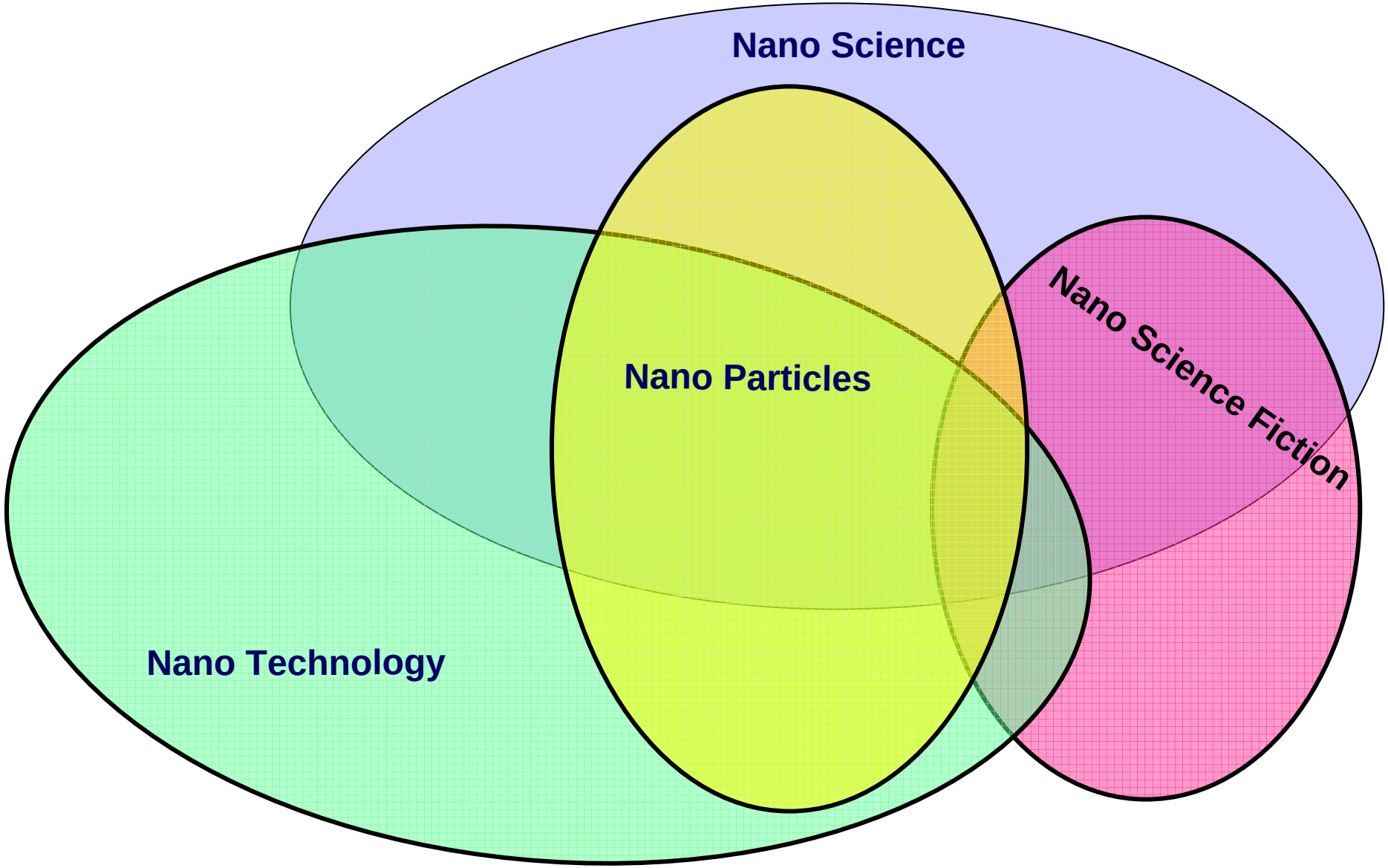
Universities

- DK – Aarhus
- NL – Amsterdam
- BE – Leuven
- UK – Essex
- DE - Darmstadt

NanoCap activities

- **Five internal Working Conferences**
- **Public final conference**
  - **(Brussels, April 2009)**
- **Website (www.nanocap.eu)**
- **Electronic newsletters**
- **Participation in the public debate**
- **Meetings/discussions with industry, authorities, other stakeholders**

Nano terminology



Nanoparticles (NP)

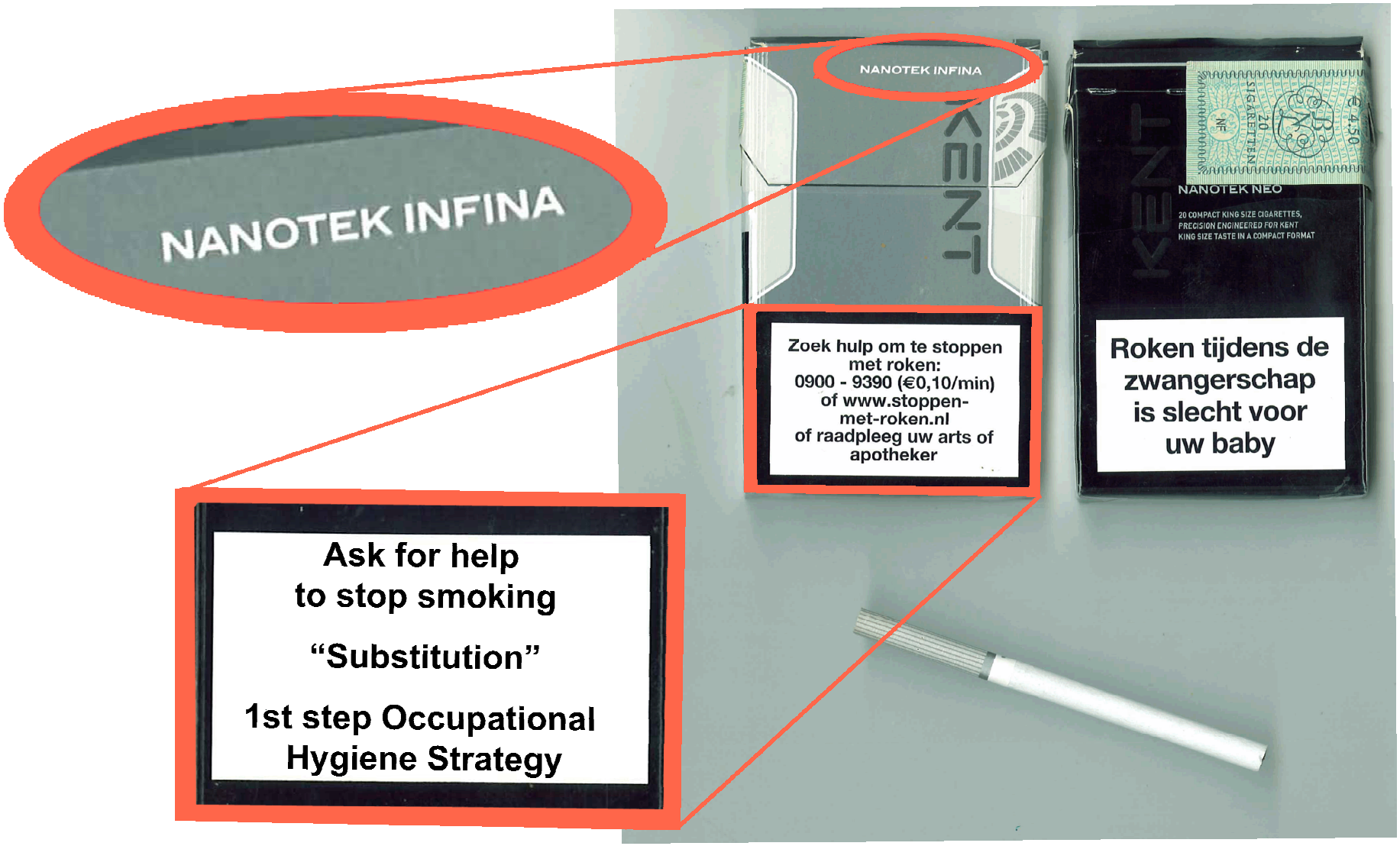
- **NP < 100 nm**
  - 1nm = 0.001 μm = 0,000001 mm = 0,000000001m = 10^{-9}m
  - Atoms ~10^{-10} m ……Molecules ~ 10^{-9}-10^{-8} m
- **Non-manufactured "well-known" NPs**
  - Industrial pollutants: *Diesel-exhaust, welding fumes*
  - Natural pollutants: *Sea salt, forest fire smoke, vulcanism*
- **Manufactured NPs**
  - Well-known 'old' products: *carbon-black, asbestos*
  - many new developments:

Important NP properties

- Size (nano)
- Dimension:
  - 1D (surface), 2D (rod, tube, needle..), 3D (sphere)
- Form
  - Crystal, amorphous, porosity
- Water-solubility
- Persistence (biodegradability)
- (Photo)reactivity
- Charge
- Etc.

Many types of NPs

- **Nanosized versions of 'old' substances**
  - TiO_2 (cosmetics: sun tan cream, glidant in powders, water & dirt repellent at glass windows and textiles)
  - SiO_2 = silicium dioxide (coatings, chips, tooth paste...)
  - Ag (biocidal, hygienic purposes)
  - Fe etc. (environmental remediation)
  - Al
- **New nanomaterials**
  - 'fullerenes' (or 'buckyballs')
  - carbon nanotubes (filler epoxy, tennisracket, ropes..)


NANOTEK INFINA
NANOTEK INFINA
KENT
Zoek hulp om te stoppen
met roken:
0900 - 9390 (€0,10/min)
of www.stoppen-
met-roken.nl
of raadpleeg uw arts of
apotheker
KENT
NANOTEK NEO
20 COMPACT KING SIZE CIGARETTES,
PRECISION ENGINEERED FOR KENT
KING SIZE TASTE IN A COMPACT FORMAT
Roken tijdens de
zwangerschap
is slecht voor
uw baby
Ask for help
to stop smoking
“Substitution”
1st step Occupational
Hygiene Strategy

Construction industry example

Bioni Hygienic:

- Anti microbial Wall Coating
- Acryl-Dispersion with Nano Silver Suspension (~13nm)

On MSDS:

No special measures mentioned

Construction industry example

Arctic Snow Professional Interior Paint

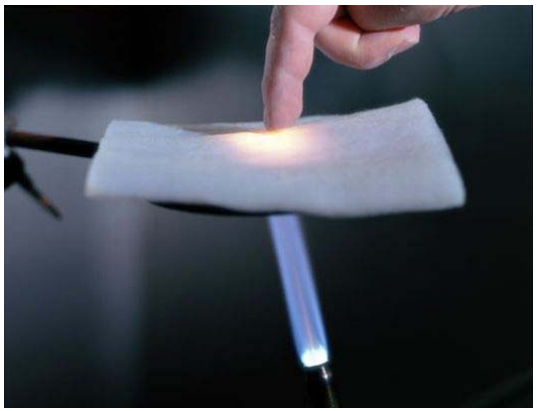
- TiO_2 **nano**-particles

Arctic paint LTD.

Construction industry example

Insulair NP, insulation blankets

- Flexible, **nano**-porous gel, nano “bubbles”



INSULCON

REFRACTORY & CERAMIC INNOVATION

aspen aerogels

NANOTECHNOLOGY AT WORK™

Construction industry example

EMACO® Nanocrete,

- Structural repair of concrete elements
- contains: Silica fume (SiO_2 **nano**-particles)

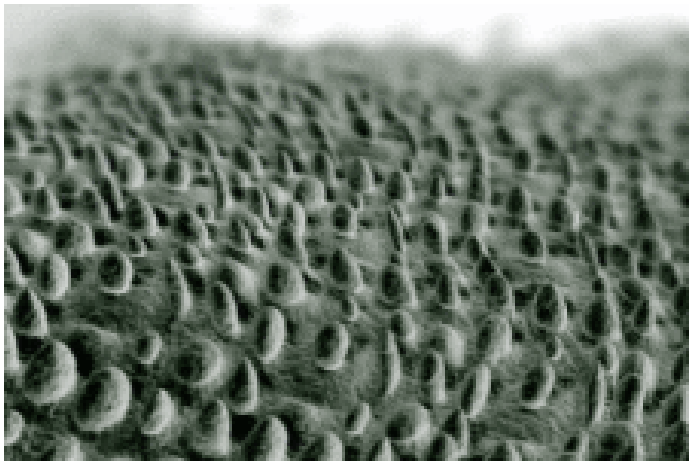
MSDS: Xi: Irritant
R37/38 Irritating to respiratory system
R41: Risk of serious damage to eyes

The lotus effect- Self-cleaning effect based on extremely water-repellent behavior known as superhydrophobia.

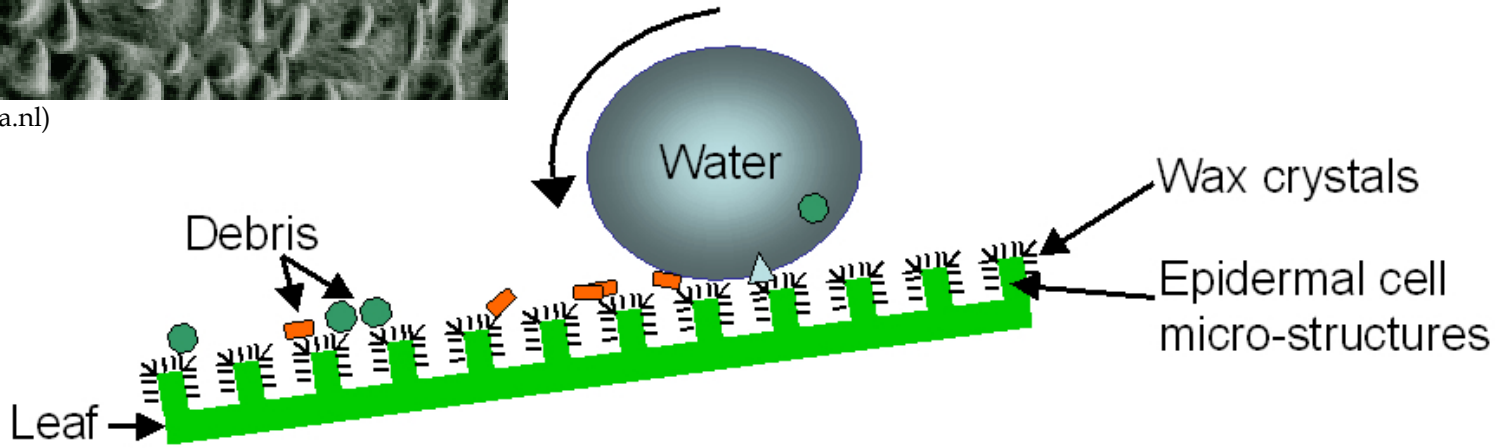
(www.agrocourier.com)

(Harald Keller, BASF)

“Papillae” on the leaf, about 5 to 10 micrometers high are themselves coated by a fine nanostructure of wax crystals.

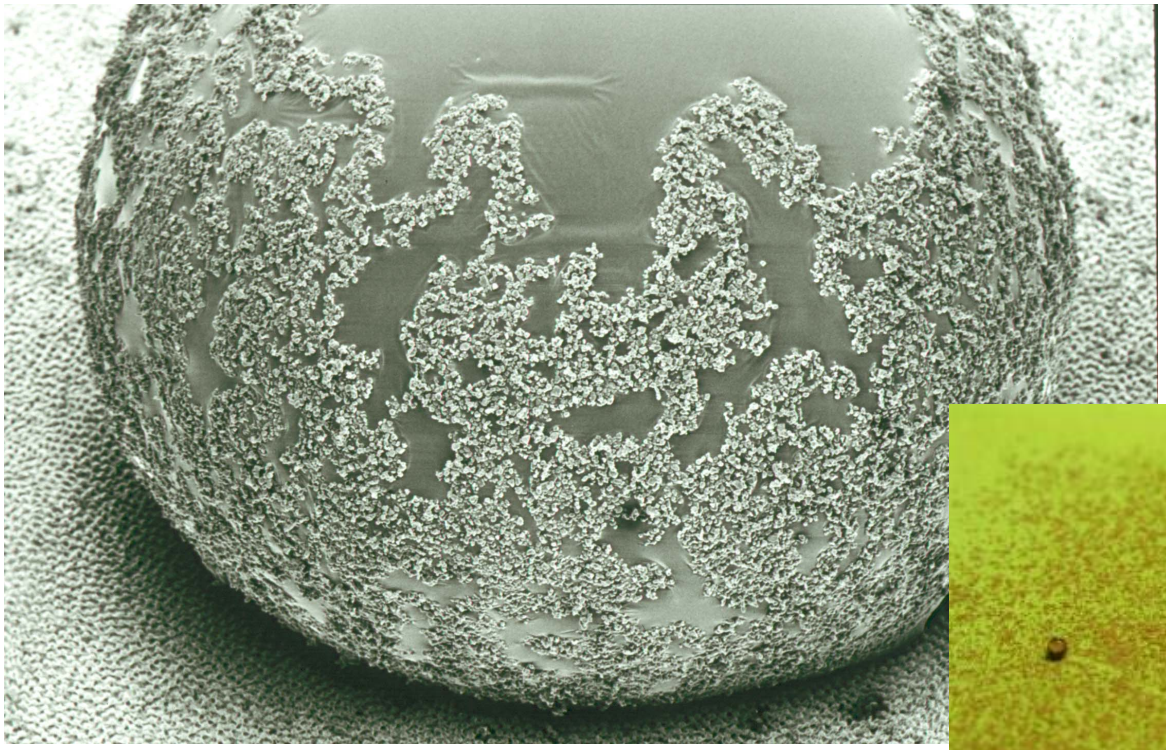


(www.res-bona.nl)

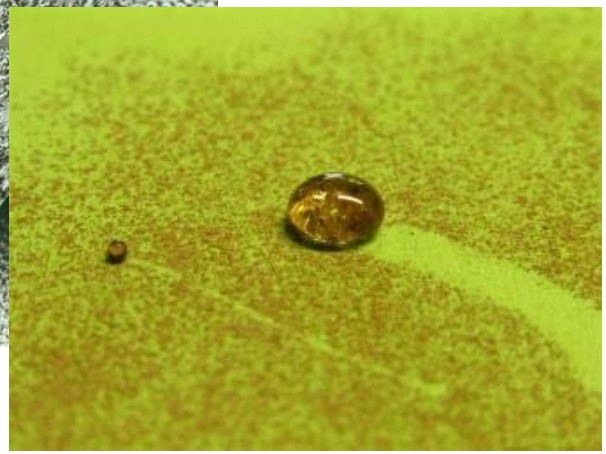


(www.thenakedscientists.com)

Water droplets form spherical globules that easily roll off of leafes only slightly inclined. Particles of dirt become absorbed and removed.



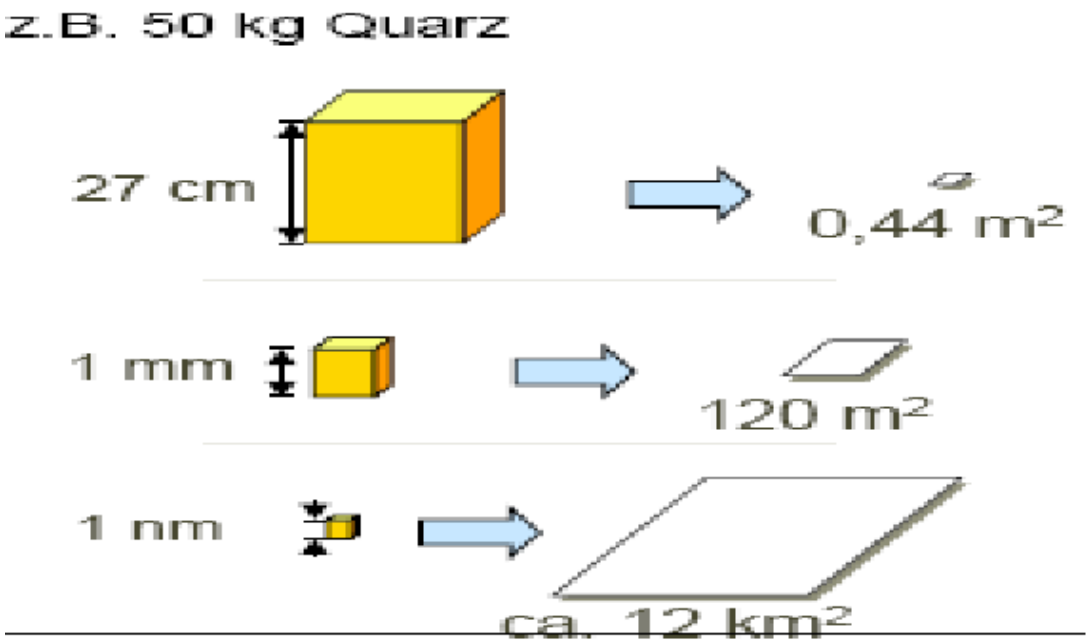
(www.corporate.basf.com)



(www.bio-pro.de)

What is different with NPs?

- **Toxic effect surface-based rather than mass-based**
  - The same weight of nano-particles has a much larger surface than the larger particles



What else with NPs?

- **Shape, crystal stucture, aggregation and surface structure important determinants of hazard**
  - Surface activity may generate toxic effect
- **Many new combinations of substances**
- **Airborne NPs behave as a gass**
  - NP (ca.50nm) Deposition preferably in deep lungs (alveoli)

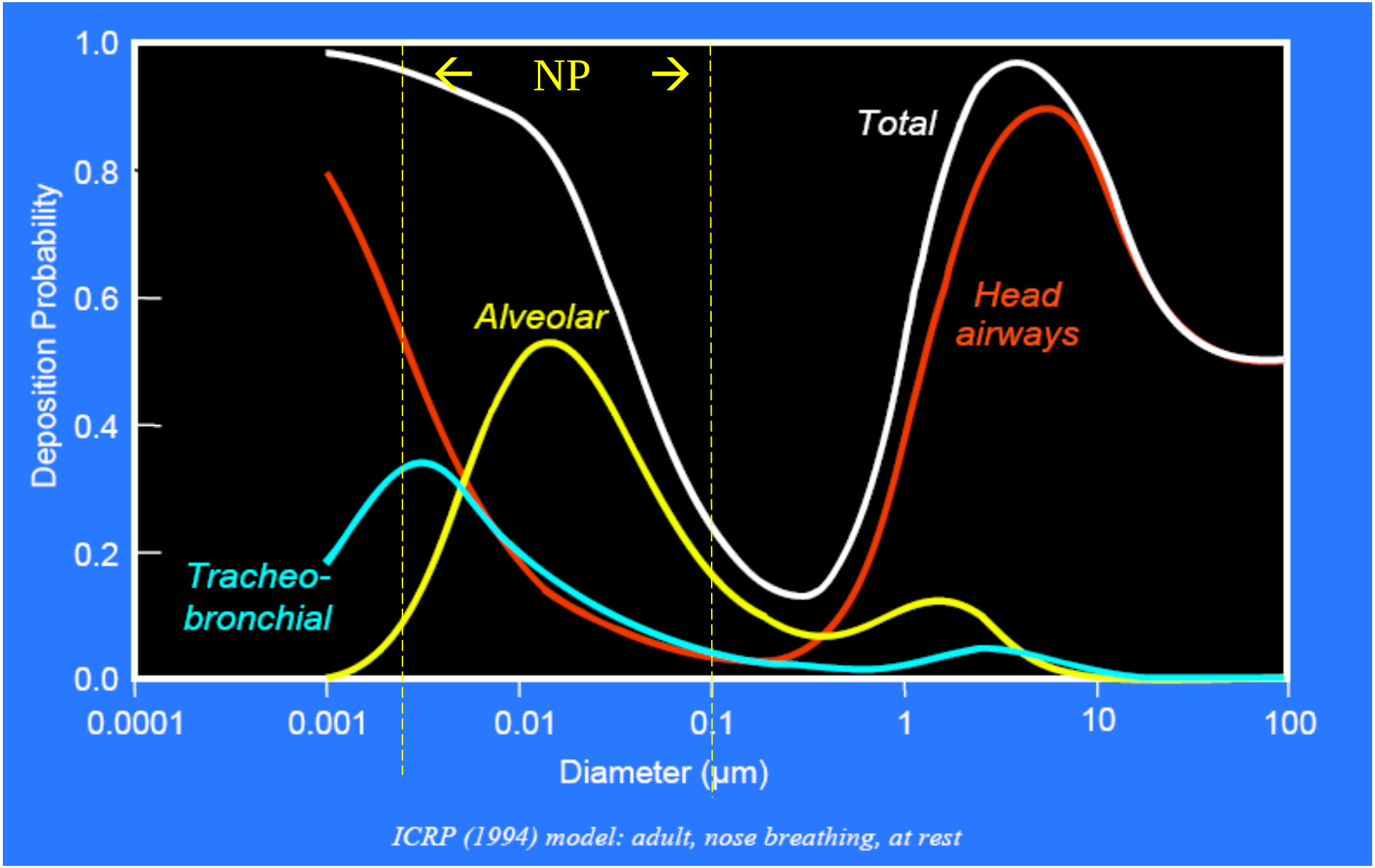
Consequence of larger surface on toxicity

- **Example calculation of Nano-OEL**
- **based on different size of active surface area**

……..TiO_2: Actual (NIOSH-US) OEL **1,5mg/m3**

→ **nano-TiO_2**: NIOSH–calculation: **0,1mg/m3**

Predicted deposition of inhaled particles in the human respiratory tract



Who might be at risk?

- **Exposure to nanomaterials**
  - Production/handling/packaging & maintenance/ cleaning workers
  - Transport
  - Secondary users
  - End-users and consumers
  - Disposal

  ➢ Normal operations, accidents (leaks)
  ➢ Inhalation, dermal and other routes of exposure

Industry and NT

- **Strong competition in Industry → confidentiallity about NP-products**
  - Limited info on risks
  - Limited accession to products composition
  - Limited accession to workplace measurements
  - Agreements on not analysing purchased NP raw materials

Check on
Status of Scientific Knowledge

- **What we know we know**
- **What we know we don’t know**
- **What we don’t know we don’t know**
- **What we don’t know we know**

Status of Scientific Knowledge

What we know we know "knowledge"

- Health effects of ultrafines, air pollution and fibres **+++**
- Control approach of ultrafines particles in the workplace **+++**
- Importance of specific properties for toxicity **++**
- Evidence relevant health effects of NP in animal models **++**

Status of Scientific Knowledge

What we know we don't know

"questions"

- Absorption routes and extent of translocation **+**
- Measurement and characterisation techniques **+**
- Importance of dermal exposure **+/-**
- Health effects in workers **+/-**
- Environmenetal effects **+/-**

Status of Scientific Knowledge

What we don’t know we don’t know

“Maybe we know, maybe not”

- Effectiveness of control -
- Advisability medical screening and biological monitoring -
- Risk for workers’ families -
- Unanticipated new hazards and controls ?

Status of Scientific Knowledge

What we don’t know we know

NanoCap 2006 – 2009

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Scheme for a Preliminary Risk Assessment of Candidate Nanoparticles