TECHNOLOGICA Group

KATHOLIEKE UNIVERSITEIT LEUVEN

Industrial Safety Challenges and Advanced Materials

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FP7 – NMP

What are the objectives and background of Nanosciences & Nanotechnologies, Materials and New Production Technology (NMP)?

Objectives :

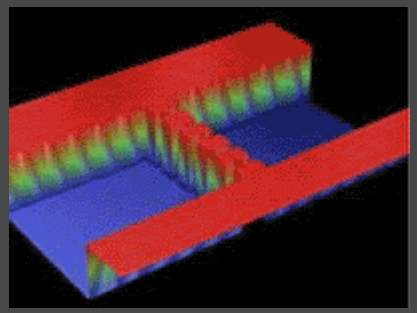
Improve the competitiveness of EU industry (including SMEs) and ensure its transformation through:

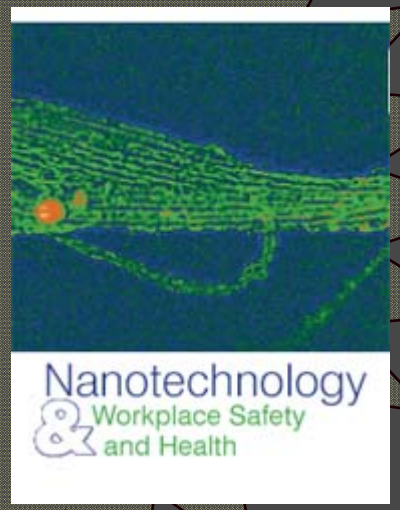
- the effective transition from a resource-based to knowledgebased industry
- generation of knowledge and radical innovations
- strengthening EU leadership in nano, materials and production technologies
- emphasis on integrating different technologies and disciplines across many sectors

Background :

- To enhance its competitiveness, European industry needs radical innovations. It must concentrate its capabilities on high-added-value products and technologies to meet customer requirements, as well as environmental, health and other societal expectations.
- ….
- Strong contributions to industrial needs and complementarities through initiatives and funded projects will be ensured in particular through European Technology Platforms (e.g. in the potential areas of sustainable chemistry, new manufacturing, **industrial safety**, nanomedicine, steel, forest-based sector etc) and support to Joint Technology Initiatives.

1. Nanotechnologies





Nanotechnology : New Chances, New Risks

The prefix “nano” is derived from the Greek word for dwarf (nánnos). A nanometre (nm) is one millionth of a millimetre (e.g. a single human hair is about 80,000 nm wide). The term nanotechnology refers to a range of technologies performed on a nanometre scale with widespread applications.

Application

Nanotechnologies offer a lot of benefits and new possibilities in the field of medical applications, chemistry, as well as information and communication technology. Although nanotechnological research is still at the beginning, a wide variety of nanoscale materials and surfaces are already in use in cosmetics, textiles, household cleaning products, filters, paints and coatings as well as in food.

Possible risks

Nanotechnology is considered to be a key technology of the 21st century, but the uncertainty of its effects on man and the environment gives some cause for concern and remains to be elucidated. Nanomaterials are defined as substance particles smaller than 100 nm and associated with very large surface to volume ratios resulting in different physical and chemical properties as well as higher reactivity. Therefore, it is not possible to extrapolate from the toxicology of non-nanosized forms of the same substance to the toxicology of the nanosized materials.

Effects on human health and on the environment

When considering the hazards associated with nanoparticles, the size, the shape, the surface (including surface charge) and the chemical composition of the nanoparticle are important. There are many open questions concerning the absorption, distribution, metabolism and excretion of nanosized material in the human body. However, some nanoparticles may translocate through membranes, and neuronal uptake, translocation in the axon and the potential to cross the blood brain barrier have also been reported. One mechanism of the toxicity of nanoparticles is likely to be the induction of oxidative stress in cells resulting in cytotoxicity and inflammation. An important aspect of risk assessment that needs to be clarified as well is the potential for persistence of nanoparticles in humans and the potential for bioaccumulation in the environment.

Testing methods

Conventional toxicity and ecotoxicity tests have already been shown to be useful in evaluating hazards of nanoparticles. However, some methods may require modification and some new testing methods may also be needed. For routine characterization of the physico-chemical properties of nanoparticles appropriate methodologies must be made available. Furthermore, (to provide a basis for evaluating the risk and the risk-reducing measures to be implemented,) methodologies and equipment need to be developed for routine measurements of representative exposure to free nanoparticles.

Conclusion

In order to ensure the safe use of nanomaterials and the ensuing benefits, it is necessary to lay the legal and methodological foundations for evaluating the long-term effects of nanotechnology on man and the environment.

Nanotechnologies – *Workplan*

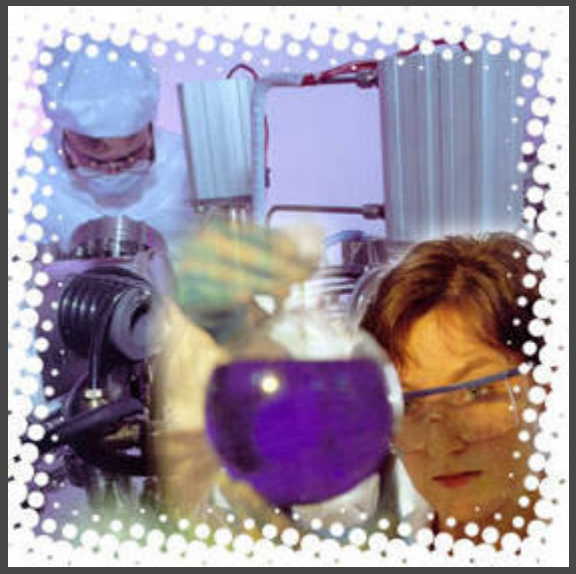
4.1.3 Health, Safety and Environmental Impacts

The main objective is to support the scientific assessment of the potential health, safety and environmental risks associated with nanotechnology-based materials and products at the earliest possible stage.

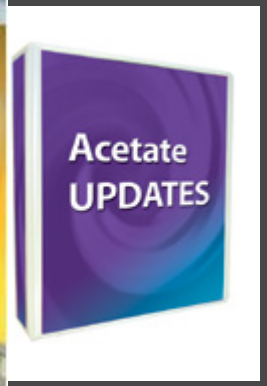
This involves the generation of quantitative data on toxicology and ecotoxicology and methodologies for generating data. Test methods, exposure assessment and risk assessment methods may need to be developed or modified to be applicable to nanomaterials, as well as methodologies for life cycle analysis. In addition, analytical methods might not be fully suitable and therefore also the development of suitable devices and instruments for measurement are addressed. Research activities will thus contribute to close the knowledge gap, providing the basis for meeting regulatory requirements and, if need be, developing new requirements, conducive to a safe, responsible and sustainable development.

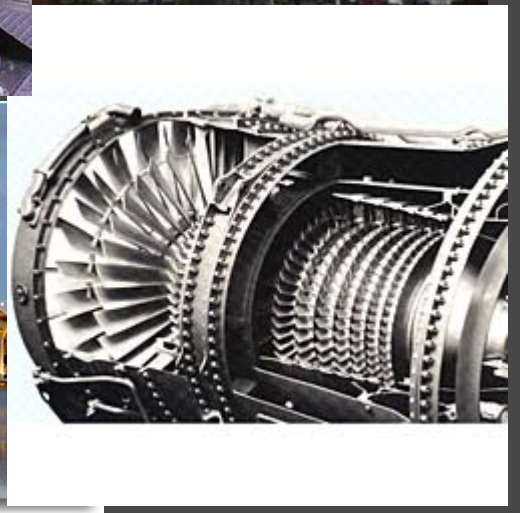
- **NMP-2007-1.3-1 Specific, easy-to-use portable devices for measurement and analysis [...]**
- **NMP-2007-1.3-2 Risk assessment of engineered nanoparticles on health and the environment [...]**
- **NMP-2007-1.3-3 Scientific review of the data and studies on the potential impact of engineered nano-particles on health, safety and the environment [...]**
- **NMP-2007-1.3-4 Creation of a critical and commented database on the health, safety and environmental impact of nanoparticles [...]**
- **NMP-2007-1.3-5 Coordination in studying the environmental, safety and health impact of engineered nanoparticles and nanotechnology based materials and products [...]**

2. Advanced Materials



Advanced Materials : New Risks, New Chances & Opportunities …





Advanced Materials – *Workplan*

4.2 Materials

- Materials are key for today's technological advances and therefore their applications are highly relevant to all the other FP7 Themes. Theme NMP mainly focuses on advanced materials design, development and processing, while other Themes are more concerned with research related to the use of materials in their respective fields of application.
- Added value materials with higher knowledge content, new functionalities and improved performance are increasingly critical for industrial competitiveness and sustainable development. According to the new models of the manufacturing industry, it is the materials themselves which are becoming the first step in increasing the value of products and their performance, rather than the production steps.
- Research will focus on developing new knowledge-based multifunctional surfaces and materials with tailored properties and predictable performance, for new products and processes targeting a wide range of applications. This requires the control of intrinsic properties, processing and production, taking into account **potential impacts on health, safety** and the environment throughout their entire life-cycle.

Extreme Conditions & Environments

4.2.5-1 Novel materials tailored for extreme conditions and environments

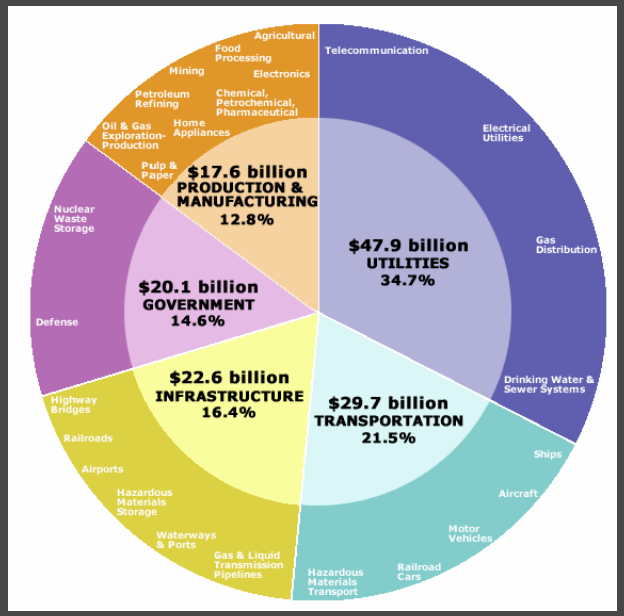
Technical content / scope :

- Materials especially tailored for extreme conditions and environments, which are resistant to very high or very low temperatures, radiation, high pressures, high electromagnetic fields, damaging chemical reactions such as corrosive or oxidizing environments, biodegradation, or several of these conditions at the same time, are becoming increasingly important in a variety of industrial fields.
- Research should focus on radical innovations in the properties and processing of bulk or surface treated materials designed for extreme environments, based on an enhanced understanding of materials degradation.
- Composite materials, metallic materials, and engineering ceramics need further development, but also new alternatives are sought for wide industrial applications (e.g. turbines, engines, aerospace and maritime applications, machinery, sensors and the chemical industry).

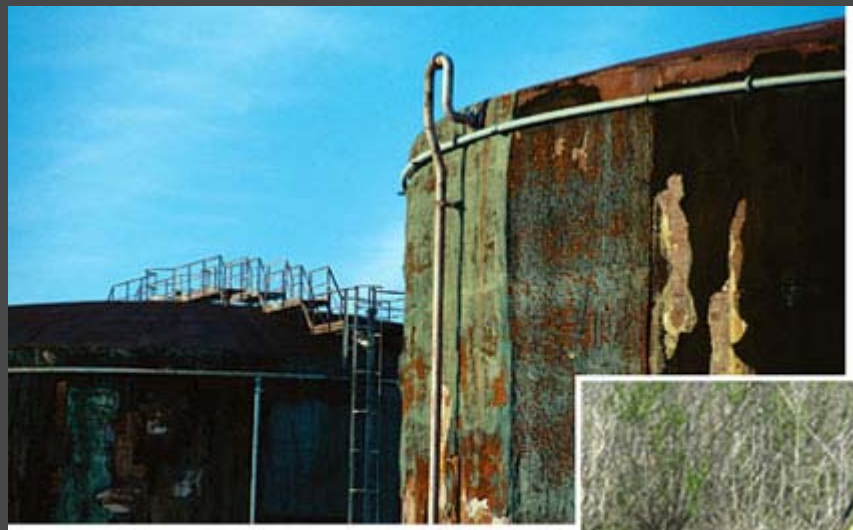
Importance

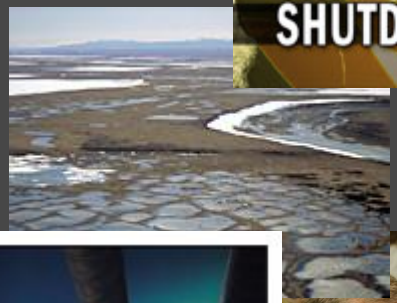
Some Industry Sectors …

Cost of Corrosion & Materials Degradation



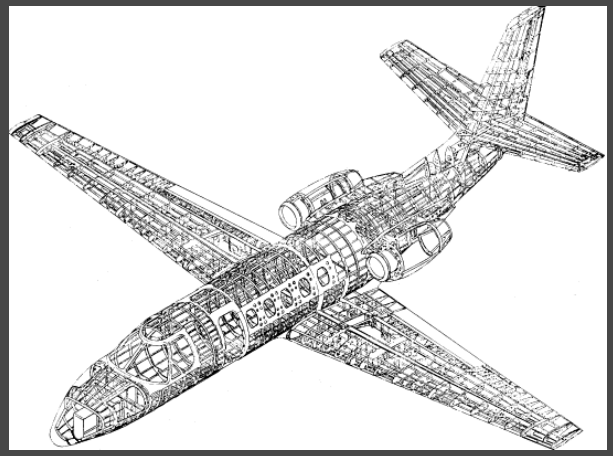
Environment & Conservation of Materials



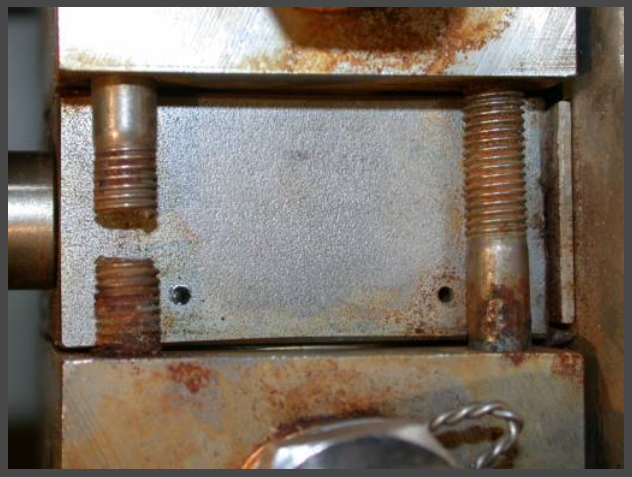


Alaska

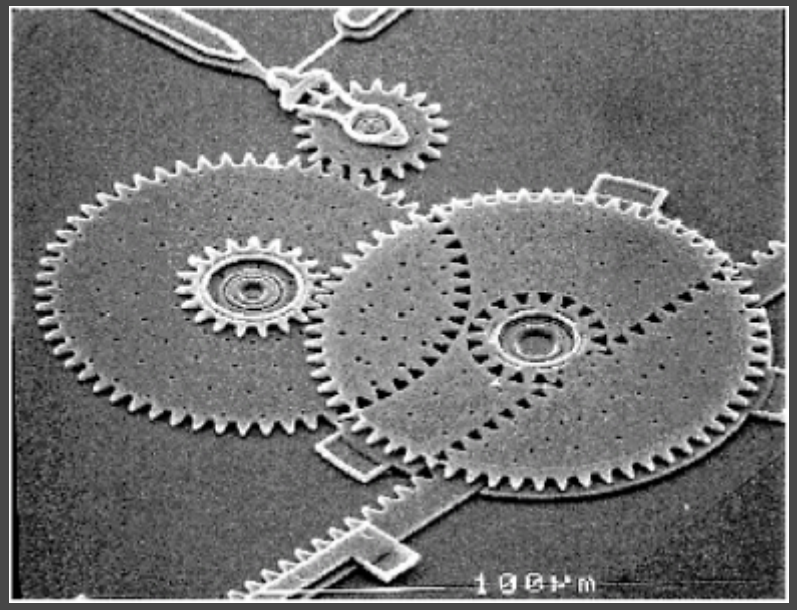
Safety …



Gas pipe



3. New Production Technologies



New Production – *Workplan*

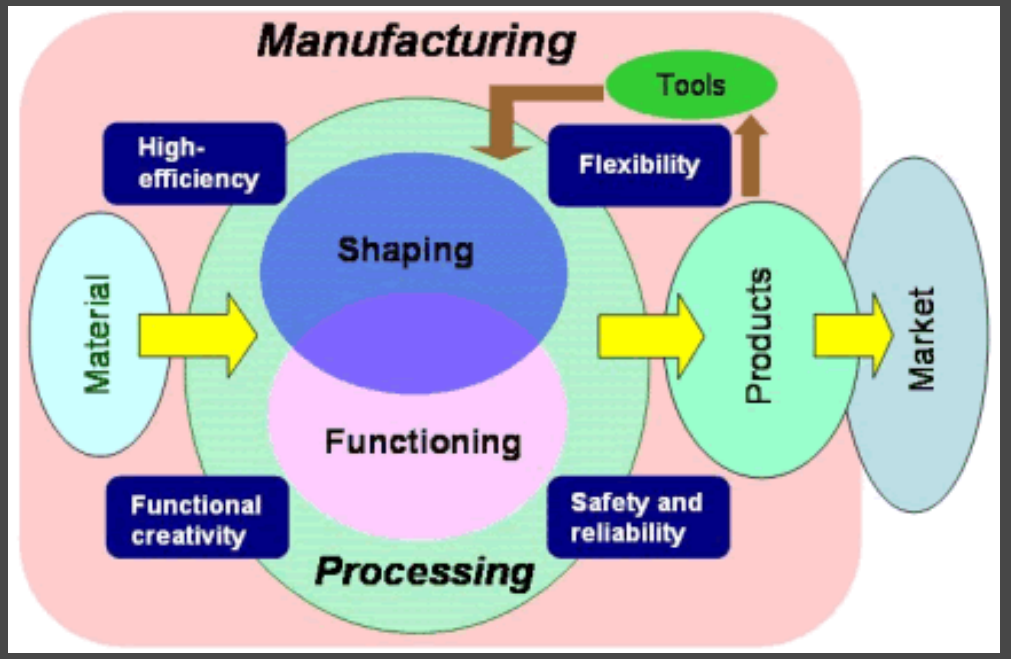
4.3 New production

A new approach to manufacturing is required for the transformation of EU industry from a resource intensive to a sustainable knowledge-based industrial environment and will depend on the adoption of totally new attitudes towards the continued acquisition, deployment, protection and funding of new knowledge and its use, including towards sustainable production and consumption patterns.

This entails creating the appropriate conditions for continuous innovation (in industrial activities and production systems, including design, construction, devices, and services) and for developing generic production “assets” (technologies, organisation and production facilities as well as human resources, while also meeting overall industrial safety and environmental requirements.

These production assets will come together in “Factories made in Europe” with European standards.

➔ 4. Integrated Risk Management



Integrated Risk Management

New Paradigms …
& New {interdisciplinary}
R&D Urgently Needed

Integrated Risk Management –

Workplan ***NMP***

4.3.1-3 Integrated … management in industrial systems

- The value chain bas… …on activities have become more complex with more interrelations and interdependenc… **new technologies** and **materials** that introduce **new risks in a changing enviro…** the same time society is becom… The shift to a new safe… …efore required. … of integrated method… (including multi-h… …f space and increa… …mpact to so… …an heal… (ergo… will conti… …d to a new…
- **Cost-… …ms to reduce risks of haz…** …including preventive and protective techno… …, human-centred design production systems, risk-based r… …assessment on the economy, society, the environment and health, systems for data collection, new monitoring techniques and methods, new training methods and technologies addressing the increasing needs for competencies, transfer of new knowledge, and life long learning systems of the workers and managers responsible for safe operations.

CLEAR LINK (and RTD NEED) :

“ Industrial Safety Challenges and Advanced Materials ” …