PACKAGING, TRANSPORT & LOGISTICS RESEARCH CENTER

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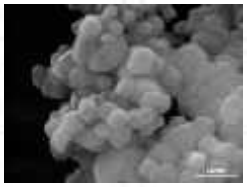
NANOMICEX
Mitigation of risk by means of safe by design approaches and effective engineering controls



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ITENE – Head of Safety Technological Area & NanoSafety Group
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Helsinki, April 15th, 2015

Join Workshop “Operational occupational Risk Management Models and tools for MNMs in the industry” / SENN Conference

SENN2015

nanoMICEX

NANOMICEX is a collaborative project funded by the European Community´s Seventh Framework Programme (FP7/2007 – 2013) under Grant Agreement n. 280713

1. NanoMICEX project: Objectives and Consortium

General Information

- Project Title: Mitigation of risk and control of exposure in nanotechnology based inks and pigments
- Theme: NMP Theme of the European Commission's 7th Framework Programme.
- Call Identifier: FP7-NMP-2011-SMALL-5

  NMP.2011.1.3-2 Worker protection and exposure risk management strategies for nanomaterial production, use and disposal
- Grant Agreement nº: NMP4-SL-2012-280713

Official starting date: 1rst of April 2012
Duration of the project: 36 months
Ending date: 31th of March 2015

- Coordinator: Carlos Fito (ITENE)

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1. NanoMICEX project: Objectives and Consortium

❑ Our Consortium

The consortium of the NANOMICEX project consists of **6 RTDs** and **6 Industrial Partners** (1 SME Association, 3 SMEs and 2 larger companies) from 7 Countries: Spain, UK, Turkey, Belgium, Italy, France and Germany.

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1. NanoMICEX project: Objectives and Consortium

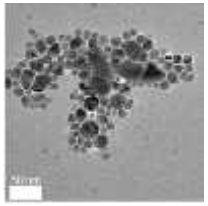
The **main objective** of NANOMICEX project is **to reduce the potential risk upon worker's exposure to the ENPs** employed in large scale by **printing ink, paint and pigment industry**, covering an extensive range of high-tech applications and added value properties

Main Goals

- ✓ To design **biocompatible surface modifiers** to reduce the potential hazardous properties of the ENPs of special concern, considering both changes on (eco)toxicological profile and functions in paint and ink formulations
- ✓ To characterize the **exposure to NPs** (exposure scenarios) in real operative conditions, and to assess the potential impact and evaluate the risk posed by ENPs on workers at the different life cycle stages
- ✓ To assess the **effectiveness of existing RMMs** against ENPs, and define cost effective strategies to reduce the exposure
- ✓ To validate the results in several cases studies and taking into account the product functionality, cost, and exploitation opportunities

Target NPs

- Zinc Oxide NPs (ZnO)
- Titanium Oxide (TiO2)
- Fe_3O_4 Nanoparticles
- **Ag metal** nanoparticles
- Aluminium Oxide (Al_2O_3)
- **Cobalt Aluminate spinel** ($CoAl_2O_4$)
- **CdSe** Quantum Dots (QDs)



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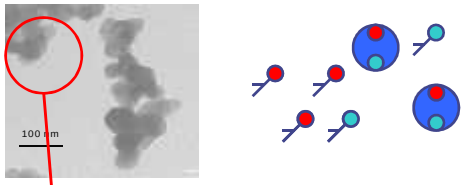
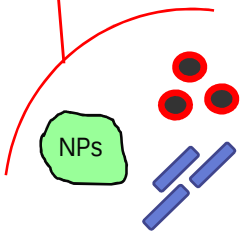
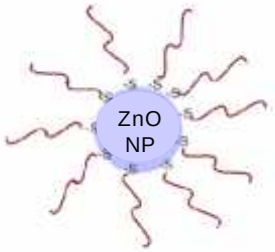
2. Work plan and concept

❑ Overall Concept





1. NPs Characterization



2. Surface Modification

Hazard & Exposure measurements

Effectiveness Testing

Case Studies

Nano SLCRA: Adaptive Streamlined Life Cycle / Risk Assessment

2. Work plan and concept

❑ Working Plan

NANOMICEX consists of 9 complementary Work Packages (WP).

This work plan has been split into **4 types of activities** based on the combined experience of the consortium members. These activities are:

- Scientific and Technological development
- Validation and Demonstration activities
- Project Management
- Dissemination Related Activities

WP n°	WP Title	WP Leader
1	Characterization of engineered nanoparticles	HU
2	Development and selection of functional modified nanoparticles	YU
3	Hazard Assessment	HWU
4	Exposure Assessment	IOM
5	Risk Management and Control Measures	ITENE
6	Nano SLCRA: Adaptive Streamlined Life Cycle / Risk Assessment of nanoparticle-based inks and pigments	LEITAT
7	Industrial Case Studies	ARDEJE
8	Project Coordination and Management	ITENE
9	Project dissemination and training	NIA

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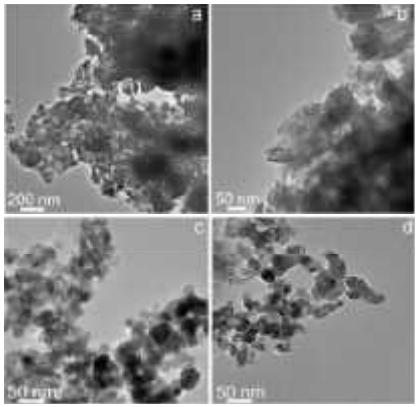
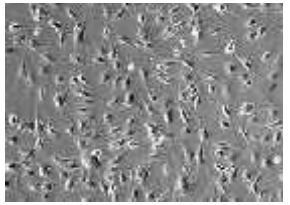
3. Main Outcomes from the project

Key Results

- Complete **characterization of the target NPs**, including information for key parameters for (eco)toxicological assessment
- A compendium of **proven surface modifiers based on bio-ligands:**
  - MOx-NPs: surface modification based on the attachment of Bovine serum albumin (BSA) onto silica coated ZnO NPs
  - CdSe-ZnS QDs: toxicity of the QDs reduced by coating them with a silica layer and modifying the silica layer further with glucose.
- A complete **description of the toxicological and ecotoxicological** properties: Ag > ZnO > CdSe QDs > Fe_2O_3 = Al_2O_3 = $CoAl_2O_4$ = TiO_2





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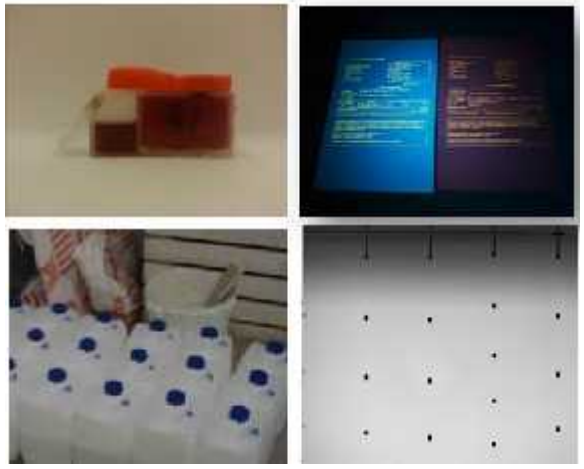
3. Main Outcomes from the project

- Critical **exposure scenarios identified**: (1) synthesis via a pyrolysis reaction; (2 / 3) harvesting/isolating synthesized or functionalized ENPs; (4) drying an ENPs paste to a powder; 5) milling an ENPs powder; (6) charging a process with powdered ENPs; (7 – 8) packaging and maintenance work

- Reliable data **effectiveness of conventional RMMs** used at industrial level: respiratory protection identified as key priority. The use of Butyl rubber gloves and Tyvek type suits showed high performance

- Five **validation studies completed**: scaling up and cost analysis of safe by design approaches in 3 companies + industrial validation of the performance of new pigments and ink jet formulations based on surface modified ZnO and QDs



- Dissemination in more than **12 international events** + networking with ISO committees

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¡THANK YOU FOR YOUR ATTENTION!

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