FUNDING PROGRAMME: PNCDI III - European and International Cooperation
SUBPROGRAM: ERA-NET – SIINN ERA-NET
FP7 - ERA-NET SIINN

PROJECT TITLE/ACRONYM: Nanoparticle Aerosols: Influence of surfactants deposited in the lungs and effects on breathing – NANOaers

CONTRACT NO.: 12/2016

TOTAL PROJECT BUDGET: - **INCDTP'S BUDGET:** 121.477 Euro

PROJECT STARTING DATA: 01.05.2016 **PROJECT ENDING DATA:** 31.01.2020

PAGINA WEB: https://nanopartikel.info/en/research/projects/nanoaers/

PARTNERS:

Lead: German Federal Institute for Risk Assessment/ Bundesinstitut für Risikobewertung, BfR, Berlin, Germany

Partner 1: Institute of Process Engineering and Envionmental Technology (Institut für Verfahrenstechnik und Umwelttechnik), IVU, TU Dresden (TUD), Dresden, Germany

Partner 2: Institute of Fluid Mechanics and Heat Transfer, TU Graz, Austria

Partner 3: GAIKER-IK4 Foundation, Zamudio, Spain

Partner 4: Harvard School of Public Health (HSPH) , Boston, MA, USA

Partner 5: National Institute of Standards and Technology, NIST, Gaithersburg, MD, USA

Partner 6: Institutul Naţional de Cercetare-Dezvoltare pentru Textile şi Pielărie, INCDTP, Bucharest, Romania

GENERAL OBJECTIVES:

The general objective of the project was derived from the objectives of the European project "Nanoparticle fate in air and human body barriers: factors determining deposition and uptake (NANOaers)

- To study the influence of aerosolisation and chemical surface-active substances on the fate of nanomaterials and their potential subsequent uptake by airway epithelium and effects.
- To exemplarily the different fates of two representative classes of manufactured nanomaterials relevant for inhalation exposure. To specify the nano-effect, all experiments and investigations will additionally be conducted with micro-sized particles:

-soluble particles with a substance-specific toxicity using the example of silver nanoparticles (Nano-Ag)
-granular bio durable particles (GBP) using the example of cerium dioxide nanoparticles (Nano-CeO_2)

SPECIFIC OBJECTIVES:

- ✓ Definition of technical specifications of textile materials used as impact plates;
- ✓ Definition of characteristics of Ag and CeO2-based nanoparticle dispersions and of technological processes for treating textile materials;
- ✓ Selection of textile materials intended for impact plates for spraying processes (BBC, BBC/pes, Pes) and definition of physicochemical characteristics;
- ✓ Textile matrices functionalized with CeO_2 and Ag;
- ✓ Study of migration kinetics of CeO_2 and Ag NP.

NOVELTY ELEMENTS/ SCIENTIFIC CONCEPT:

The use of manufactured nanomaterials (MNM) in particulate form is increasing steadily, but little is known

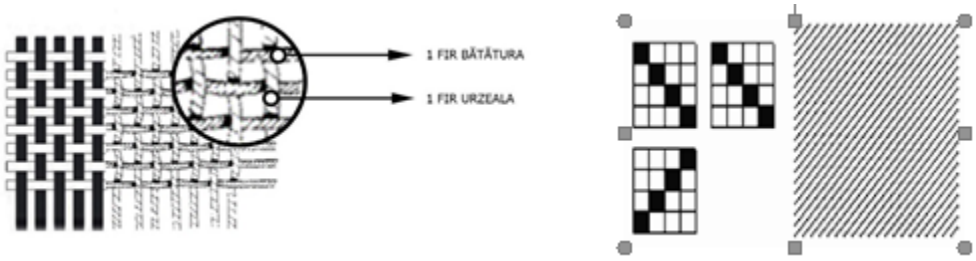
about their fate and effects after release into the airborne state and subsequent deposition in the respiratory tract. Especially the influence of matrix effects in liquid formulations on the fate of nanomaterials, e.g., their ability to absorb other substances and serve as a carrier to otherwise inaccessible sites in the lungs of organisms, remains to be investigated. These aspects are necessary as humans and the environment are hardly exposed to manufactured nanomaterials that are not altered by any chemical substances, either coming from the products they are used in or by reactions in the atmosphere. Thus, for the first time, the **ERA-Net SIINN project NANOaers** addresses the open question regarding the influence of aerosolisation and of chemical surface-active substances on the fate of nanomaterials and their potential subsequent uptake by airway epithelium and effects. The project combines physicochemical and toxicological *in vitro*-3D cell models, precision cut lung slices (PCLS) and *in vivo* experiments.

EXPECTED EXPLOITABLE RESULTS:

- ❖ Characterisation report of Ag and CeO2 nanoparticles
- ❖ Woven and knitted textile matrices
- ❖ Hydrophobic and oleophobic textile matrices
- ❖ Textile matrices functionalized with CeO2 and Ag by spraying and stuffing technologies
- ❖ Evaluation report of the antifungal efficiency of fabrics and knitwear (N)
- ❖ Analysis report of the uniformity, morphology and distribution of nanoparticles on the surface of textile matrix
- ❖ Study on the migration kinetics of CeO2 and Ag NP
- ❖ Dissemination of project results

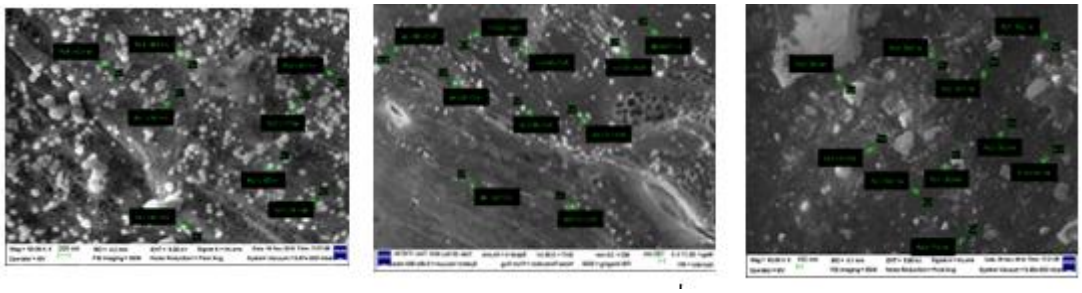
OBTAINED RESULTS:

- ✓ Textile matrices made of: 100% cotton, 55% polyester/45% cotton and 100% polyester, white and dyed, functionality through: CeO2 NP spraying technology, on a testing device made at the UT in Dresden, after oleophobization with Rukostar EEF6 or Nuva N 2114 can be achieved by impregnation (padding), where the oleophobization treatment is applied simultaneously with functionalization using CeO_2 and Ag NP.



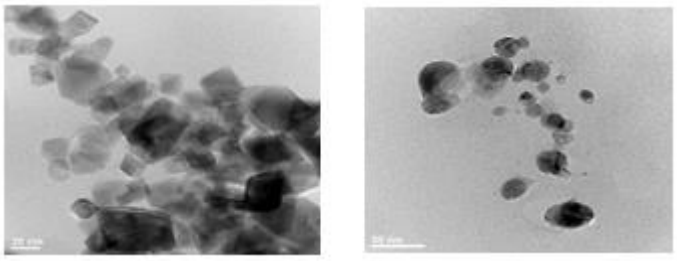
Fundamental woven matrix bonds: a) plain, b) diagonal

- ✓ Analysis reports of the size and shape of CeO_2 and Ag NPs obtained using scanning electron microscopy (SEM), transmission TEM and dynamic light scattering (DLS)



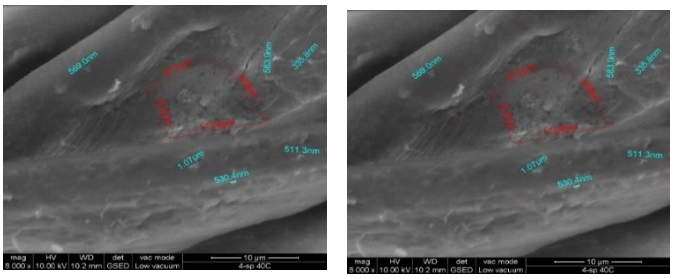
SEM images of particle distribution

- ✓ Evaluation of the influence of finishing auxiliaries and technological processes on the quantity of particles deposited on/in the material; evaluation of the influence of surface modifications of nano-AG and CeO2 induced by additives used in dispersions on the uniformity and quantity of deposited nanoparticles.



Ce O_2 and Ag particles

- ✓ Determination of the migration kinetics of CeO_2 and Ag particles in sweat solutions and during washing and wearing processes (rubbing);
- ✓ Evaluation of the antifungal efficiency of knitwear treated with CeO_2 against three strains: *Candida albicans*, *Trichophyton interdigitale* and *Epidermophyton floccosum* which highlighted that it is better in the case of oleophobization with Nuva N2114 and functionalization with CeO2 in solvent dispersion for knitwear made of 100% cotton and 45% cotton/55% polyester, dyed.
- ✓ Dissemination of the project results.



SEM images after washing test

DISSEMINATION, PATENT APPLICATIONS, AWARDS:

- **BDI published papers:**
  1. **Visileanu Emilia, Ene Alexandra, Mihai Carmen, Scarlat Razvan, Radulescu Razvan,** *The influence of functionalization technologies with nanoparticles on the sustainability of induced effects, Annals of Oradea University,* Fascicle of Textiles-Leather Work, vol. II, pag. 79, 2019
  2. **Emilia Visileanu, Laura Chiriac, Cornelia Mitran, Razvan Scarlat, Dana Ciutaru,** *Evaluarea eficieneti functionalizarii materialelor textile cu oxid de ceriu, Buletin AGIR, ISSN -L1224-7929, Index Copernicus International, Academic Keys, getCited, nr.3/2019, pag.74-77.*
  3. **Emilia Visileanu, Ene Alexandra, Mihai Carmen, Scarlat Razvan, Radulescu Razvan,** *Influence of functionalization technologies with nanoparticles on the sustainability of induced effects,* Annals of the University of Oradea, Fascicle of Textiles, Leatherwork, Editura Universitatii din Oradea, E-ISSN-ISSN-2457-4880, indexata in EBESCO, DOAJ, Ulrich's Update, pag.79-80.
- **Scientific communications:**
  1. **Emilia Visileanu, Iuliana Dumitrescu, Laura Chiriac, Elena Perdum, Cornelia Mitran,** *Textile impact plates for nanoparticles*, International Conference: Innovative solution for sustainable development of textiles and leather industry, 26-27.05.2017, Oradea, Romania
  2. **Emilia Visileanu, Iuliana Dumitrescu, Laura Chiriac, Elena Perdum, Cornelia Mitran,** *Textile impact plates for nanoparticles,* Proceedings of International Scientific Conference- 26-27.05.2017, Oradea, Romania, Vol.XVIII, E-ISSN-ISSN-2457-4880, pag.97-98
  3. L. Hilleman, D. Goler, Sandra Wagner, Claudia Cascio, Jutta Tentschert, **Emilia Visileanu,** Helfried Steiner, Gunter Bren, *Fate of aerosolized Nanoparticles: The influence of surface active substances on lung deposition and respiratory effects* (NANOaers), European Aerosol Conference, 27.08-01.09.2017, Elvetia
  4. **Emilia Visileanu, Iuliana Dumitrescu, Elena Varzaru, Cornelia Mitran, Laura Chiriac,** *Textile impact plates for the study of nanoparticle influence on health*, International Conference: TEXTEH 8-Creating the future of textiles - 19-20.10.2017, Bucharest, Romania
  5. **Emilia Visileanu -** *Nanoparticle Aerosols: Influence of surfactants deposited in the lungs and effects on breathing* - Poster – Research Salon 2017, Palace of Parliament -26-27.10.2017, Bucharest, Romania
  6. **Emilia Visileanu**, „4th Project Meeting NANoaers", „ *Ag and CO_2NPs treatment and woven fabrics*

characterization" 05-06.02.2018, Dresden, Germany.

7. **Emilia Visileanu, Iuliana Dumitrescu, Elena Perdum, Cornelia Mitran,** *Research on nanoparticle-treated impact plates,* AGIR Sympozium: Technological Progress-Research Result, XIIIth Edition, 26.06.2018, Bucharest, Romania.
8. **Emilia Visileanu, Iuliana Dumitrescu, Elena Perdum, Cornelia Mitran,** *Influence of additives on the characteristics of nanoparticles,* International Scientific Conference: Innovative solution for sustainable development of textiles and leather industry, Faculty of Energy Engineering, and Industrial Management, 24-25. 05.2018, Oradea, România.


9. **Emilia Visileanu** – "Intermediate Raport Phase III-2018" – 29-30.08.2018, Harvard T.H. Chan School of Public Health in Boston MA, 29-30.08.2018 USA din Boston, SUA.
10. Frank S. Bierkandt, Sandra Wagener, Jutta Tentschert, Harald Jungnickel, Peter Laux, Andreas Luch, Lars Hillemann, Paul Bergelt, Michael Stintz, **Emilia Visileanu** and all, *Characterization of spray aerosols generated from particle-free solutions and nano-particle containing suspensions (NANOaers),* IAC 2018 - The International Conference in St. Louis: 02-07.09.2018 (poster).
11. **Emilia Visileanu**, Frank S. Bierkandt, Paul Bergel, Sandra Wagener, Jutta Tentschert, Peter Laux, Andreas Luch *"Textile impact boards for aerosols with nanoparticles* The 8th International Conference of Applied Research on Textiles, CIRAT, 09-10.11.2018 **-** Monastir, Tunisia
12. **Emilia Visileanu, Alexandra Ene, Razvan Scarlat, Laura Chiriac, Cornelia Mitran** *„Technologies for the functionalization of textile mats with nanoparticles"* Textile Science & Economy 2019 French-Croatian Forum, Zagreb, Croatia: 24-25.01.2019

13. **Emilia Visileanu**, „6th Project Meeting NANoaers „ *Ag NPs treatment and knitted fabrics characterization"* 07- 08.02.2019, Graz, Austria
14. **Emilia Visileanu, Alexandra Ene, Razvan Scarlat, Laura Chiriac, Cornelia Mitran,** *„Aspects regarding durability of the treatments with nanoparticles"* ICTC- International Conference on Textile and Clothing - 2019, Lahore, Pakistan, 08-09.03.2019
15. **Emilia Visileanu, Laura Chiriac, Cornelia Mitran, Razvan Scarlat, Dana Ciutaru,** *Evaluation of the efficiency of textile materials functionalized with cerium oxide*, Technological progress Conference, XIVth Edition, AGIR, 09.05.2019, Bucharest, Romania
16. **Emilia Visileanu, Ene Alexandra, Mihai Carmen, Scarlat Razvan, Radulescu Razvan,** *Influence of functionalization technologies with nanoparticles on the sustainability of induced effects,* "International Scientific Conference: Innovative solutions for sustainable development of textiles and leather industry" 23-24.05.2019, Oradea, Romania – oral presentation.
17. **Emilia Visileanu,** *General concluzions regarding the functionalization of textile materials with nanoparticles;* Assessment and Toxicology of Spray Application and Nano-enabled Products for Consumers, Work-shop and Expert meeting, Berlin, Germany, 21-22.01.2020

Book:

- **Emilia Visileanu, Laura Chiriac, Cornelia Mitran, Razvan Scarlat**
  „Tehnologii de functionalizare a materialelor textile cu nanoparticole”
  Industria Textile, ISBN 978-973-1716-99-2, Certex Publishing House 2019

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