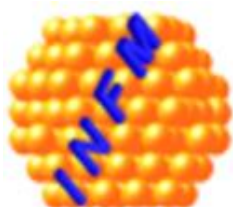


FUNDING PROGRAMME: PNCDI III, Program 1-Development of the national Research and Development system
SUBPROGRAM: 1.2. Institutional Performance Complex Projects carried out by RDI consortia
PROJECT TITLE/ACRONYM: Interinstitutional program for the development of advanced solutions based on eco-nanotechnologies for multifunctional treatments of textile and leather materials, PHYSforTel
CONTRACT NO.: 144/2020
TOTAL PROJECT BUDGET: 1102000 lei/ 232000 euro **INCDTP'S BUDGET:** 570000 lei/120000 euro
PROJECT STARTING DATA: 08/03/2020 **PROJECT ENDING DATA:** 08/03/2022
PAGINA WEB: <https://incdtp.ro/icpi/proiecte.html>

PARTNERS:

- Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH)-coordinator
- The National Institute for Research and Development for Materials Physics (INCDFM)- partner 1
- The National Institute for Research and Development for Textiles Leather (INCDTP)-partner 2
- The National Institute for Research and Development of Isotopic and Molecular Technologies (INCDTIM) –partner 3
- University of Bucharest (UB)- partner 4
- "Petru Poni" Institute of Macromolecular Chemistry Iasi (ICMPP)- partner 5



GENERAL OBJECTIVES:

The production of textile and leather materials with multifunctional, advanced properties, by approaching integrated functionalization eco-nanotechnologies using physical techniques (gamma irradiation, cold plasma activation, electrodeposition) and nanocomposites with antibacterial, antistatic or hydrophobic properties.

SPECIFIC OBJECTIVES/ EXECUTION PHASES:

Interdisciplinary involvement in achieving the specific objectives of the 4 component projects:

Project 1: Integrated eco-nanotechnologies of gamma irradiation for obtaining textile and leather materials with improved properties through disinfection, sterilization, grafting, crosslinking.

Project 2: Composite materials based on inorganic nanoparticles, functionalized with polymers, deposited on textile and leather materials through eco-nanotechnologies, for the creation of surfaces with advanced properties.

Project 3: Integrated solutions for multifunctional treatment of textile and leather materials for the creation of advanced products (antistatic, antimicrobial, hydrophobic).

Project 4: Development of eco-nanotechnologies for the functionalization of the surface of textile and leather materials through cold plasma treatment at atmospheric pressure.

Project 5: Development of advanced materials and eco-nanotechnologies of coating for the creation of superhydrophobic and amphiphobic surfaces for textiles and leather.

NOVELTY ELEMENTS/ SCIENTIFIC CONCEPT:

Development of integrated eco-functionalization nanotechnologies using physical methods (gamma irradiation, plasma activation, electrodeposition) and nanocomposites with antibacterial, antistatic or hydrophobic properties leading to the production of textile and leather materials with advanced multifunctional properties. Replacement and reduction of volatile organic chemical materials with adverse environmental impact which creates the premises for the transfer of advanced technologies to manufacturers of medical items, protective equipment, sports or other applications and the creation of new research services by the partners of the PHYSforTeL consortium for the benefit of a traditional industrial sector, the textile and leather industry.

EXPECTED EXPLOITABLE RESULTS:

Development of ecological technologies by using gamma radiation, plasma and intelligent nanocomposites for the processing of textile and leather materials.

Achieving advanced properties by using new nanocomposites and activating their action through unconventional methods.

Achieving processes with reduced ecological impact by reducing the consumption of water and chemical materials.

OBTAINED RESULTS:

- Technologies for preserving rawhides, wet-blue and crust with gamma radiation (Fig. A)
- Technologies for finishing textile materials with UV-protective nanocomposites (Fig. B)

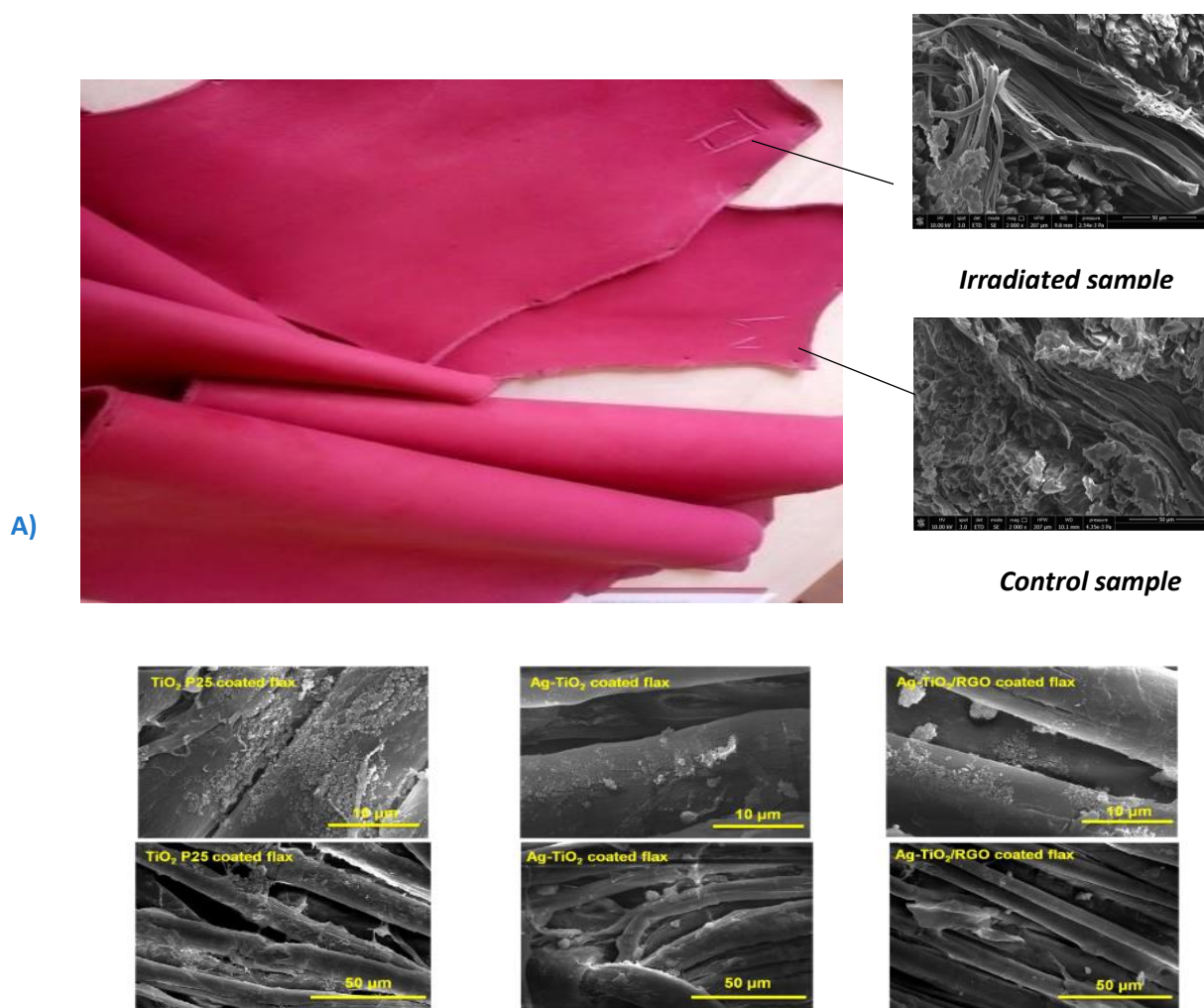


Fig. 1. SEM images of coated flax samples.

Figure A) Leather treated with gamma radiation compared to classic ones, with similar morphologies and B) linen fibers coated with nano materials with UV radiation protection

- Studies on the interaction of textile and leather materials with gamma radiation;

- 10 Technologies for treating textile and leather materials in order to obtain advanced self-cleaning, antimicrobial, antistatic, conductive or hydrophobic properties of the surface;
- 1 method for functionalizing the surface of textiles and leather by plasma treatment;
- 12 new materials functionalized with the help of gamma radiation, nanoparticle composites, conductive polymers or combinations thereof;
- 2 services for manufacturers regarding the functionalization of textile or leather materials;
- 7 training courses and 7 visits.

DISSEMINATION, PATENT APPLICATIONS, AWARDS:

- **WoS published papers: 5**

► A.O. Mateescu, G. Mateescu, I. Burducea, P. Mereuta, L. Chirila, A. Popescu, M. Stroe, A. Nila, M. Baibarac, Textile materials treatment with mixture of TiO₂: N and SiO₂ nanoparticles for improvement of their self-cleaning properties, J. Natural Fibers 2020, DOI: 10.1080/15440478.2020.1818349.

► L. Chirila, D.V. Cosma, A. Urda, A.S. Porav, A. Turza, D. Timpu, A.O. Mateescu, UV lightshielding properties of TiO₂-based materials coated flax samples, Journal of optoelectronics and advanced materials, 22(1-2) (2020) 62 – 66. <https://joam.inoe.ro/articles/uv-light-shielding-properties-of-tio2-based-materials-coated-flax-samples/fulltext>

► Carmen Gaidau, Ioana Rodica Stanculescu, Maria Stanca, Mihalis Cutrubinis, Laura Trandafir, Mioara Alexandru, Cosmin-Andrei Alexe, Gamma irradiation a green alternative for hides and leather conservation, Radiation Physics and Chemistry, Volume 182, May 2021, 109369, ISSN 0969-806X, <https://doi.org/10.1016/j.radphyschem.2021.109369>, (<https://www.sciencedirect.com/science/article/pii/S0969806X21000190>).

► Maria Stanca , Carmen Gaidau 1,*, Cosmin-Andrei Alexe , Ioana Stanculescu *, Silvana Vasilca, Andreea Matei , Demetra Simion and Roxana-Rodica Constantinescu, Multifunctional Leather Surface Design by Using Carbon Nanotube-Based Composites, Materials 2021, 14(11), 3003; <https://doi.org/10.3390/ma14113003>.

► Cosmin Alexe; Carmen Gaidau; Ioana Stanculescu; Gheorghe Mateescu; Alice Mateescu; Mihaela Baibarac; Malvina Stroe; Andreea Radu, Multifunctional Leather Surfaces Covered with Nanocomposites through Conventional and Unconventional Methods, Materials Today: Proceedings, 54,33, 2021, DOI: 10.1016/j.matpr.2021.09.377.

- **BDI published papers: 3**

► M.-C.Rosu, Alin-Sebastian Porav, AlexandruTurza, Carmen Gaidau, Laura Chirila, Daniel Timpu, Gheorghe Mateescu, Ioana-RodicaStanculescu, UV protective properties of Ag -TiO₂/reduced graphene oxide -modified flax fabrics, 3rd Autumn School of Physics of Advanced Materials, PAMS-3, September 22-28, 2018, Heraklion Greece, www.icpam.ro T3-P14

► Marcela-Corina ROȘU, Crina SOCACI, A.-S. PORAV, A. TURZA, LauraCHIRILĂ, Carmen GAIDĂU, D. TÎMPU, Alice-Ortansa MATEESCU, Ioana-Rodica STĂNCULESCU, Self-Cleaning Properties of Cotton Gauzes Impregnated with Calcium Alginate/TiO₂-Ag/Reduced Graphene Oxide Composite Proc. 7th Int Conf Advanced Materials and Systems (ICAMS), Bucharest, Romania, October 18-20, 2018, 463-468, DOI: [10.24264/icams-2018.VIII.13](https://doi.org/10.24264/icams-2018.VIII.13)

► C. HERMAN, O. CĂPRARU, B.LUNGU, Ioana STĂNCULESCU, Maria STANCA, Carmen GAIDĂU, Treatment and Processing of Leather Materials Using Gamma Radiation, Proc. 7th Int Conf Advanced Materials and Systems (ICAMS), Bucharest, Romania, October 18-20, 2018, 503-508, ICAMS 2018 – 7th International Conference on Advanced Materials and Systems, <https://doi.org/10.24264/icams-2018.X.2>

- **Scientific communications: 2**

► D. Simion, C. Gaidau, J. Ma, W. Zhang, Q. Xu, New hybrid nanocomposite applied to the leather finishing process, with favourable environmental impact, The 11th Asian International Conference of Leather Science and

Technology, P124,p.154, Oct 16th-19th, 2018, Xi'an China, Procceding of Abstract, www.2018AICCLST.org

► M.C. Rosu, Maria Coros, Stela Pruneanu, Florina Pogacean, Valentin Mirel, Alin-Sebastian Porav, AlexandruTurza, Carmen Gaidau, Laura Chirila, Daniel Timpu, The influence of electrochemically exfoliated graphite/TiO₂ material on the surface resistivity and photocatalytic characteristics of leather, 3rd Autumn Scool of Physics of Advanced Materials, PAMS-3, September 22-28, 2018, Heraklion Greece, www.icpam.ro, T10-P3

- **Patent Applications: 3**

Cinteza O-L, Stanculescu IR, Gaidau C, Stanca M, Cutrubinis M, Constantin M., Alexe C.A., Procedeu integrat de tratare a pieilor cu chitosan, nano argint si radiatie gamma (Integrated leather treatment process with chitosan, nano silver and gamma radiation), OSIM A/00588 /28.09.2021

Gaidau Carmen, Stanca Maria, Stanculescu Ioana, Rosu Marcela-Corina, Socaci Crina- Anca, Alexe Cosmin-Andrei, Constantinescu Rodica-Roxana, Piei cu proprietati antimicrobiene durabile si procedeu de realizare a acestora, OSIM A 00572_23.09.2021

C. Gaidau, I.R. Stanculescu, M.Cutrubinis, L. Trandafir, M. Alexandru, M. Stanca, Method of leather treatment and leather preserved by gamma irradiation, EP 19464018/29.10. 2019.

- **Patent: 1**

C. Gaidau, I.R. Stanculescu, M.Cutrubinis, L. Trandafir, M. Alexandru, M. Stanca, Method of leather treatment and leather preserved by gamma irradiation, OSIM – RO 134200B1/28.07.2023.

Awards: 1

Gold medal at The XXV th International Exhibition of Inventors, Inventica Iasi, 2021 for the patent application OSIM A /00669 din 27.10.2020



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