CERTIFICATE

OF RECOGNITION

Magnus Group Conferences and Organizing Committee

wish to thank

Prof/Dr/Mr/Ms. ***Magdalena M?ynarczyk***

Central Institute for Labour Protection - National Research Institute, Poland

for phenomenal and worthy Poster presentation

at the “8th Edition of International Conference on Materials Science and Engineering” held on March 10-12, 2025 in Rome, Italy and Online

Paulo Cesar De Morais
Catholic University of Brasilia, Brazil

Stanislaw Dzwigaj
Sorbonne University, France

Materials 2025

Degradation of selected fibers as a function of maintenance cycles

Magdalena Mlynarczyk
National Research Institute, Poland

Title : Degradation of selected fibers as a function of maintenance cycles

Abstract:

With the growing issue of excess used textiles and their environmental impact, it is essential to explore solutions that extend the life cycle of clothing. Understanding how the morphology of different fiber types changes with maintenance cycles is also crucial for recommending suitable fibers for protective clothing, such as those designed, for example, intended for protection against heat.

In this study, at least three textile materials used in protective clothing intended for protection against heat —containing fibers such as viscose, cotton, and polymers—were analyzed. Materials intended for protective clothing against heat and compliant with the standards EN 11611, EN 11612, and EN 61482 were selected for the tests.

The materials were tested in their initial state and after undergoing 5, 25, and 50 maintenance cycles. All washing cycles were carried out according to EN ISO 6330 [30] at 60 °C (method 6N) and hanging drying (method A).

A scanning electron microscope was used to examine the impact of maintenance cycles on fiber morphology. The method involves scanning the surface of the examined object using an electron beam. Unfortunately, materials with poor conductivity require a conductive coating (e.g., 7 nm of gold) to reduce electron scattering on the sample surface and prevent loss of resolution. Microscopic images were taken using a field emission scanning electron microscope (FE-SEM), Hitachi SU8010 model, at an accelerating voltage of 5 kV. During the observations, in-situ measurements of the apparent widths and thicknesses of threads across the entire sample were performed.

This work presents the results of tests evaluating the impact of maintenance cycles on the morphology of the aforementioned fibers.

Acknowledge: The Polish Ministry of Family, Labour and Social Policy, agreement no. UM-1/DPP/PD/2023/02, task no.: 3.ZS.13.

Biography:

Ph.D. (Eng.) D.Sc. Magdalena Młynarczyk is Head of the Thermal Loads Laboratory at Ergonomics Department, Central Institute for Labour Protection – National Research Institute (CIOP-PIB) in Warsaw, Poland. In her professional work, she deals with the issues of heat exchange between humans and the environment, the impact of the parameters of the external environment on humans, in terms of physiological changes and the possibility of experiencing thermal comfort. She is the author of many scientific publications in international and national journals. She is also a member of inter alia: the Polish Ergonomic Society (Warsaw branch) and the Scientific and Technical Committee of FSNT-NOT Ergonomics, Occupational Protection and Technology in Medicine.

Quick Links

Venue Details

Conference Brochure

Abstract Submission

Register Now

Scientific Committee

Speakers

Program
- Scientific Sessions
- Scientific Program
- Tentative Program

Information
- Venue
- Accommodation
- Guidelines
- FAQ
- Important Dates
- Conference Brochure

About
- Past Events
- About Organizer
- Testimonials / Reviews

Contact

Submit Abstract

Register

CONFERENCE
PROGRAM

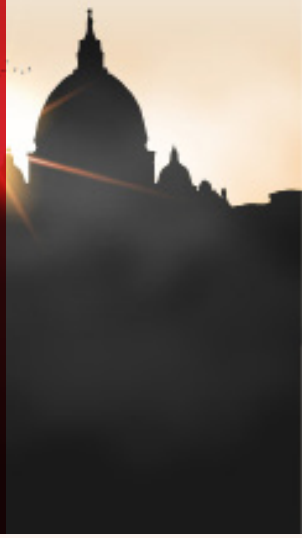
magnus Group

10TH EDITION OF

WORLD NANOTECHNOLOGY CONFERENCE &

8TH EDITION OF INTERNATIONAL CONFERENCE ON

MATERIALS SCIENCE AND ENGINEERING



10-12, MARCH, 2025

ROME, ITALY

IN-PERSON:
NH Villa Carpegna, Via Pio IV, 6, 00165 Roma RM, Italy

VIRTUAL:
Central European Time Zone

IN-PERSON VIRTUAL

(IN-PERSON)

DAY 01 Monday **MAR 10**

08:00-08:50	Registrations
08:50-09:00	Opening Ceremony and Introduction
09:00-11:00	In-person Keynote Presentations
11:30-16:00	In-person Oral Presentations
16:30-17:00	In-person Poster Presentations

11:00-11:30-Coffee Break **12:50-14:00-Lunch Break** **16:00-16:30-Coffee Break**

(IN-PERSON)

DAY 02 Tuesday **MAR 11**

08:50-09:00	Opening Note and Introduction
09:00-10:20	In-person Keynote Presentations
10:20-17:30	In-person Oral Presentations

11:00-11:30-Coffee Break **12:50-14:00-Lunch Break** **16:00-16:30-Coffee Break**

(VIRTUAL SESSION-ROOM 01)

DAY 03 Wednesday **MAR 12**

08:30-09:00	AV Check
09:00-09:40	Virtual Keynote Presentation
09:40-13:00	Virtual Oral Presentations
13:00-13:20	Virtual Poster Presentations
13:20-15:20	Virtual Keynote Presentations
15:20-16:20	Virtual Oral Presentations

(VIRTUAL SESSION-ROOM 02)

DAY 03 Wednesday **MAR 12**

08:30-09:00	AV Check
09:00-09:40	Virtual Keynote Presentation
09:40-12:40	Virtual Oral Presentations
12:40-13:20	Virtual Keynote Presentation
13:20-17:20	Virtual Oral Presentations

Important Note

- The conference follows Central European Time (CET) for both In-Person sessions and for Virtual sessions.
- When the program refers to “Local Timings” it means that the timing mentioned is based on the time zone of the presenter’s country.
- In-person presentations will take place in the **Leonardo A Room**@NH Villa Carpegna and Virtual presentations will take place in Zoom meetings.
- Please remain accessible in the hall or on Zoom throughout the day as there could be minor program adjustments due to technical issues or presenter no-shows.

	CET	Local Timings	
Virtual	12:20-12:40	13:20-13:40	

Mina Wassef Girgiss Nicola, National Research Centre, Egypt

Title: Diabetes Mellitus and nanotechnology

Virtual	12:40-13:00	19:40-20:00	

Vladimir Chigrinov, Hong Kong University of Science and Technology, Hong Kong

Title: Azodye photoaligned nanolayers for liquid crystal devices

Virtual	13:00-13:10	15:00-15:10	**Poster Presentations**

Faisal Bin Salem, King Saud University, Saudi Arabia

Title: Degradation of environmentally-friendly stabilized HDPE under accelerated weathering conditions

Virtual	13:10-13:20	13:10-13:20	

Magdalena Młynarczyk, National Research Institute, Poland

Title: Degradation of selected fibers as a function of maintenance cycles

Virtual	13:20-14:00	09:20-10:00	**Keynote Presentations**

Paulo Cesar De Morais, Catholic University of Brasilia, Brazil

Title: Exploring graphene oxide nanocomposites in cancer therapy

Virtual	14:00-14:40	21:00-21:40	

Thomas J Webster, Hebei University of Technology, China

Title: Recent advances in nanomedicine: Sensors, implants, artificial intelligence, saving the environment, human studies and more

Virtual	14:40-15:20	09:40-10:20	

Harry E. Ruda, University of Toronto, Canada

Title: Harnessing the unique transport properties of InAs nanowires for single molecule level sensing

Virtual	15:20-15:40	19:50-20:10	**Oral Presentations**

Vuppula Prasanna, Osmania University, India

Title: Developments in non-destructive testing of ceramic metal matrix composites for aerospace and defence applications

Virtual	15:40-16:00	20:10-20:30	

H. Sivaram, Rajalakshmi Institute of Technology, India
Sriram Raghavan, Rajalakshmi Institute of Technology, India

Title: Nickel-Zinc based nanomaterials for dielectric properties and antenna applications

Virtual	16:00-16:20	16:00-16:20	

Ireneusz Musiałek, Jan Kochanowski University, Poland

Title: Tests on ecological electrorheological fluid

Final Program

MATERIALS MARCH 10-12 2025

CIOP PIB

Degradation of selected fibers as a function of maintenance cycles

Magdalena MŁYNARCZYK[1] Ph.D. (Eng.), D.Sc.

Magdalena PŁOCIŃSKA[2] Ph.D., Eng.

Agnieszka GRESZTA[3] M.Sc., Eng.

[1] Department of Ergonomics, Central Institute for Labour Protection - National Research Institute, Warsaw, Poland

[2] Department of Chemical, Dust and Biological Hazards, Central Institute for Labour Protection - National Research Institute, Warsaw, Poland

[3] Department of Personal Protective Equipment, Central Institute for Labour Protection - National Research Institute, Łódź, Poland

INTRODUCTION

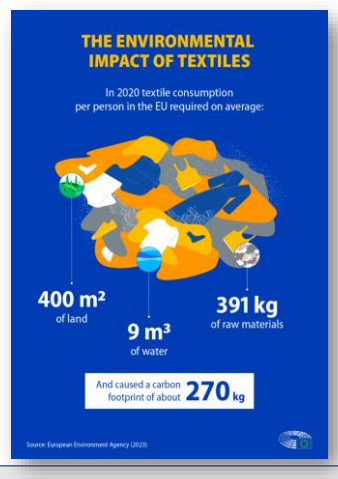
Sustainability in the textile industry is becoming an increasingly important issue, especially in the protective clothing sector for workers.
The selection of materials directly impacts the environment, and responsible production and recycling, can significantly reduce negative ecological effects.

The production of protective clothing often involves the use of synthetic materials such as:

- polyester,
- polyamide or
- aramids,

due to their durability, resistance to mechanical damage and protective properties.

However, these materials have **a large carbon footprint** and **a long time to decompose** in the environment. Their production process **requires large amounts of energy, water and generates harmful chemical emissions**.



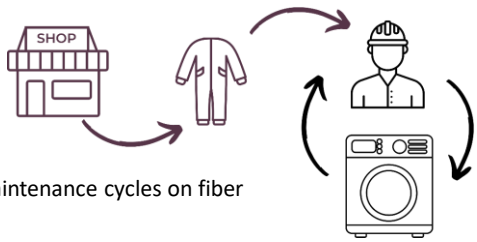
Source: https://www.europarl.europa.eu/topics/en/article/20201208STO93327/the-impact-of-textile-production-and-waste-on-the-environment-infographics

INTRODUCTION

In this study, four textile materials used in protective clothing intended for protection against heat — containing fibers such as viscose, cotton, and synthetic fibres (eg. aramid, modacrylic, polyamide) — were analyzed.

Materials intended for protective clothing against heat and compliant with the standards EN ISO 11611, EN ISO 11612 and EN 61482-2 were selected for the tests.

It should be noted that the number of maintenance cycles affects the physical (protective) parameters of a given garment. The manufacturer declares the number of maintenance cycles (washing/drying) within which the garment is expected to meet the required standards.

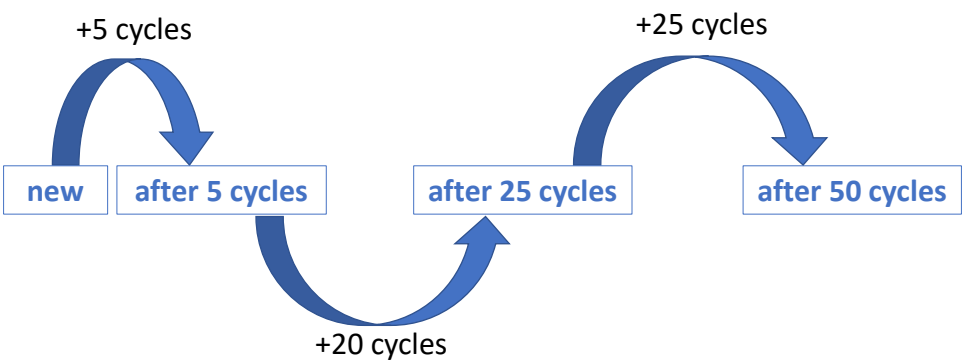


A scanning electron microscope (SEM) was used to examine the impact of maintenance cycles on fiber morphology.

The research aims to optimize fabric production processes using cellulosic fibers. This study examines the impact of maintenance cycles on the morphology of natural and artificial fibers compared to synthetic fibers, as well as their continued usability while maintaining appropriate thermal properties.

MATERIAL SAMPLES / METHODOLOGY

	M0	M1	M2	M3
COMPOSITION	93% Nomex; 5% Kevlar; 2% antistatic fiber	**25%** cotton; **10%** viscose; 42% modacrylic; 22% polyamide; 1% antistatic fiber	**75%** cotton; 24% polyester; 1% antistatic fiber	**100%** cotton



CONCLUSIONS

- A characteristic phenomenon **after the first 5 washes** is a significant **increase in the thickness of the fabrics** (by approx. 30%) **regardless of the type of fibers** used, which simultaneously results in **an increase in thermal resistance.**
- **All fabrics** show a **significant decrease in thermal resistance after 50 washing cycles**, which results from the loosening of the yarn structure and the loss of fibers and/or their degradation.
- **Degradation of fabrics** under the influence of **maintenance occurs in both natural and synthetic fibers**. **The rate of degradation depends on the type of fibers**.
- **Cellulosal fibers degrade faster**, undergoing biodegradation. On the other hand, **degradation of synthetic fibers** causes the **emission of nanoplastics** into the environment.

CONCLUSIONS

- **Analysis of the results showed** that **adding 35% of cellulosic fibers** to fabrics **reduces the consumption of synthetic materials** in production **without significantly changing the essential parameters of protective clothing.**
- **Partial replacement of synthetic fibers allows for the reduction of the use of petrochemical raw materials, reducing the impact of production on the natural environment**.

Even a small addition of natural/cellulosic fibers to fabrics reduces the negative impact on the environment.

Process optimization aims to reduce this negative impact.

MATERIALS MARCH 10-12 2025

CIOP PIB

Degradation of selected fibers as a function of maintenance cycles

Magdalena MŁYNARCZYK Ph.D. (Eng.), D.Sc.

Magdalena PŁOCIŃSKA Ph.D., Eng.

Agnieszka GRESZTA M.Sc., Eng.

Thank you for your attention

Acknowledge

This task was completed on the basis of results of research carried out within the scope of the 6th stage of the National Programme "Governmental Programme for Improvement of Safety and Working Conditions", funded by state services of the Ministry of Family, Labour and Social Policy. Task no. 3.ZS.13. The Central Institute for Labour Protection – National Research Institute is the Programme's main co-ordinator.

* e-mail: m.mlynarczyk@ciop.pl