SUPREME

SUstainable nanoPaRticles Enabled antiMicrobial surfacE coatings

Textiles | Metal | Alloys | Ceramics | Tiles | Marble | Stone slabs | Paper | Cardboard | Plastics

BREAKING NEWS

In this issue, we're excited to share the latest updates, results, and highlights from our project. For continuous updates, follow us on LinkedIn or check out our news website section.

DRIVING RESEARCH AND INNOVATION INTO SUPREME'S FINAL PHASE

SUPREME has officially entered its final year and developments are thriving across all Work Packages. From materials optimisation and antimicrobial validation to durability testing, toxicity assessment, sustainability analysis and industrial implementation, the project is advancing at full speed toward its final objectives.

This 6th edition of our newsletter brings together the latest progress from across the consortium, highlighting key achievements and next steps. It also follows our recent consortium meeting in Athens, where partners gathered to align on final developments and prepare for the project's concluding phase.

Discover how SUPREME is turning cutting-edge research into sustainable antimicrobial solutions ready for real-world impact!

SUPREME PARTNERS REUNITE IN ATHENS

From 17-18 February 2026, SUPREME partners gathered in Athens, Greece, for a productive consortium meeting, hosted by our Greek partners National and Kapodistrian University of Athens (NKUA), National Technical University of Athens (NTUA) and Orykton. The meeting provided a valuable opportunity to review progress across all Work Packages, align on final-year priorities and coordinate the next steps toward validation and impact.

As we enter the project's concluding phase, this in-person exchange strengthened collaboration and ensured a clear roadmap for the months ahead.

Read the full meeting recap on our website.

Figure 1 - SUPREME Consortium group photo in Athens, Greece

FROM LAB TO LARGER SCALE: ADVANCING CORE–SHELL PRODUCTION

Significant progress has been made in advancing SUPREME's core–shell nanomaterials from laboratory synthesis to larger-scale production. The NTUA team has focused on optimising synthesis protocols to ensure reproducibility, structural consistency and stable photocatalytic performance at increased volumes.

The results are highly promising. Advanced characterisation confirms stable activity and improved efficiency compared to earlier batches, a crucial step toward practical implementation and integration into the next stages of the project.

Figure 2 - Adamantia Zourou (School of Chemical Engineering, NTUA) during the upscaling process of TiO2@Carbon Dots@Ag core-shell material, preparing larger-volume batches for further characterization and photocatalytic testing.

As the team highlights:

"*Scaling up nanomaterials while maintaining their performance is a key challenge in applied research. Our recent progress demonstrates that the core-shell materials can be produced reliably at larger scale, bringing us closer to real-world applications.*"

With upscaling well underway, this work brings SUPREME innovation closer to industrial reality.

Figure 3 - Ioanna Kitsou (School of Mining and Metallurgical Engineering, NTUA) and Alexandra Karagianni (School of Chemical Engineering, NTUA) during a meeting discussing the characterization results of SiO2@Ag and TiO2@Carbon Dots@Ag samples, produced at large.

BUILDING DURABLE, BIO-BASED ANTIVIRAL COATINGS

Significant progress has been achieved in developing sustainable antimicrobial coatings based on microfibrillated cellulose (MFC) and polylactic acid (PLA). The University of Birmingham research team successfully formulated a stable MFC/PLA hybrid coating that can be applied to glass, PET films and metal surfaces using a simple casting process.

Structural characterisation confirmed the formation of a uniform fibrous network, where MFC fibres are embedded within the PLA matrix. Compared to pure MFC coatings, the hybrid system demonstrated improved water resistance and enhanced mechanical durability. Tribological testing further showed that the coating maintained structural integrity under both dry and wet conditions, confirming its strong wear resistance.

Importantly, antiviral testing revealed outstanding performance against SARS-CoV-2, achieving inhibition rates above 99%.

Ongoing work is now focused on incorporating functional nanoparticles to further enhance antimicrobial activity and durability, bringing these sustainable coatings closer to real-world application.

"*This work demonstrates how bio-based materials can be engineered into functional coatings with strong antiviral performance and mechanical stability. By combining cellulose fibres with biodegradable polymers, we are developing sustainable surface technologies that could be applied to everyday materials to help reduce pathogen transmission.*"

— **Dr. Ke Ren, University of Birmingham**

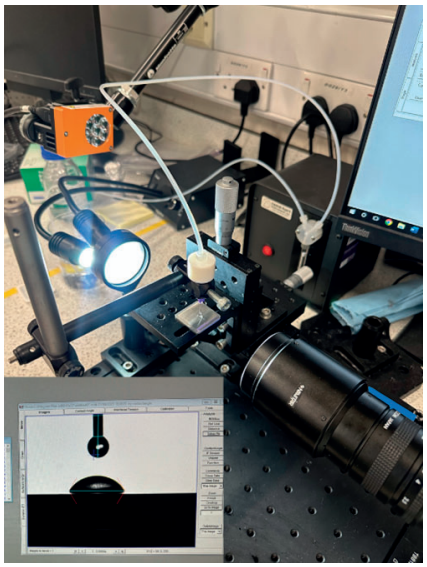

Figure 4 - Coating wettability measurement

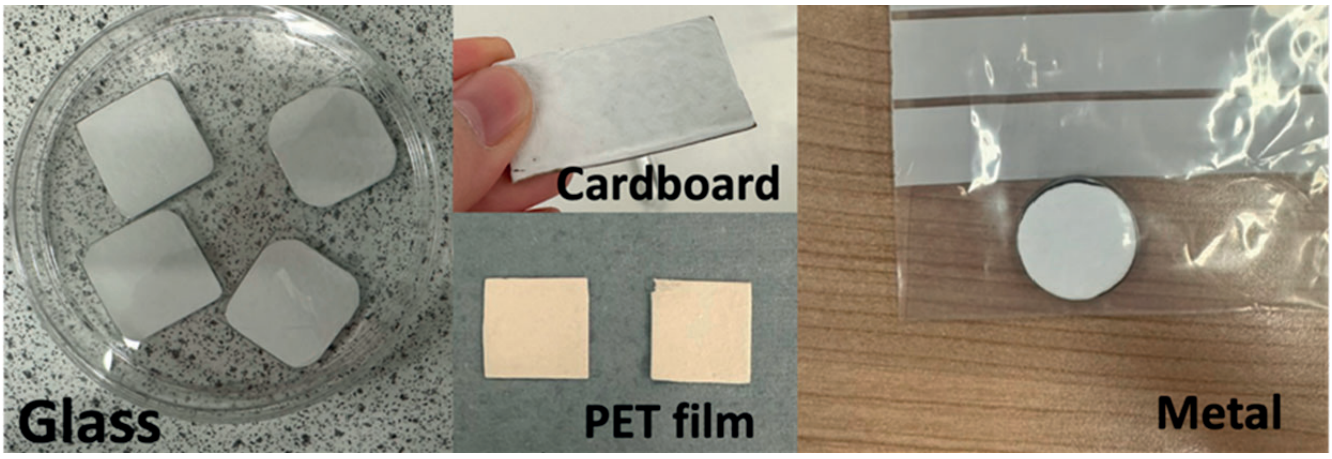

Figure 5 - MFC/PLA coatings applied on various substrates

ADVANCING HUMAN-RELEVANT SAFETY TESTING

Over the past months, major progress has been made in deepening our understanding of how SUPREME's pristine nanomaterials interact with human cells. Using a stepwise lung model that increases in complexity (culminating in air–liquid interface (ALI) exposures that closely mimic real-life conditions), the Wageningen University team is strengthening the reliability of safety assessments.

Current work focuses on uncovering the mechanisms behind nanomaterial–cell interactions. Researchers are investigating how nanomaterials enter immune cells using uptake inhibitors and developing advanced microscopy methods to visualise these processes. In parallel, new approaches are being established to measure intracellular oxidative stress, while gene-edited immune cell models help clarify how inflammatory pathways may be affected.

Together, these studies are providing deeper mechanistic insight and supporting the development of safer, human-relevant testing strategies, a key step toward sustainable-by-design materials.

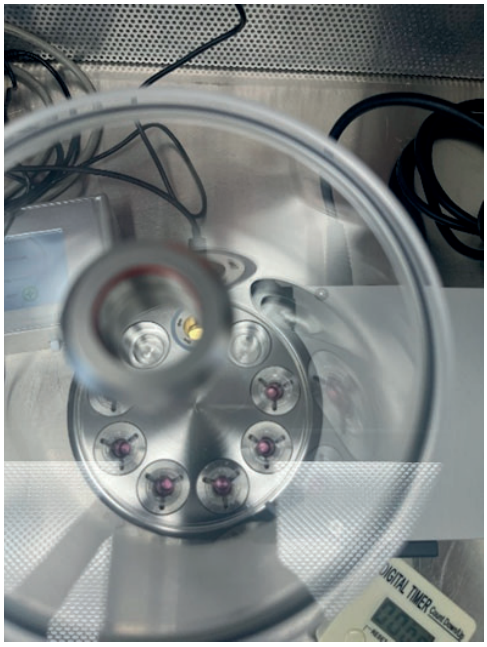

Figure 6 - Transwell cell culture inserts inside the Cloud for air-liquid interface exposure

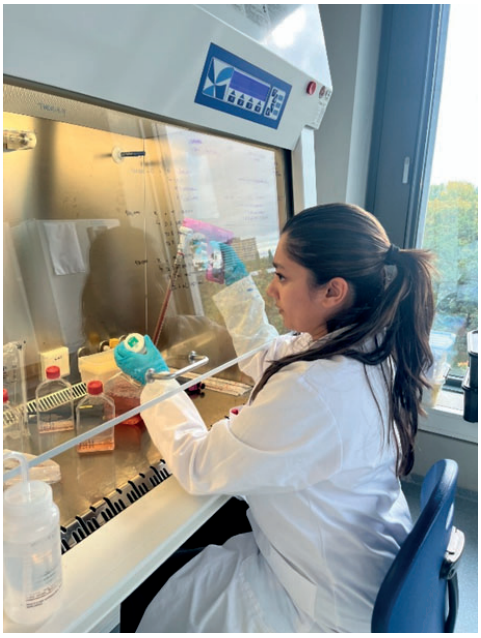

Figure 7 - General cell culture performed by MSc student Subha Aggarwal

"*It's exciting to see how each new method brings us a step closer to understanding the mechanisms behind nanomaterial–cell interactions. With every experiment, we're building knowledge that helps support the design of safer materials for the future.*"

– Tanne Meuwissen, PhD Candidate Wageningen University

FROM LABORATORY FORMULATION TO INDUSTRIAL APPLICATION

The laboratory activities carried out until now enabled the identification of the most suitable application methods for SUPREME nanocoatings on target surfaces, including textiles. Close collaboration with the materials developers from WP2 (NTUA) ensured the right quantities of nanomaterials for both laboratory and industrial-scale application.

While initial challenges in producing larger nanoparticle volumes delayed some industrial-scale trials, laboratory-scale application methods were successfully optimised wherever quantities were limited. At the same time, application procedures and material compatibility were carefully refined to support a smooth transition from laboratory to industrial production in future developments.

Importantly, the produced samples were tested in accordance with European industrial standards, reinforcing the pathway toward real-world deployment.

"*This work explores how antimicrobial coatings can transform common textiles into active barriers against harmful microorganisms. The approach has the potential to improve hygiene and safety in environments where textile surfaces play a key role.*"

– **The NTT Team.**

Figure 8 - Wood samples coated with NPs formulation. ISOMAT.

Figure 10 - 4 Textile samples coated with NPs. NTT.

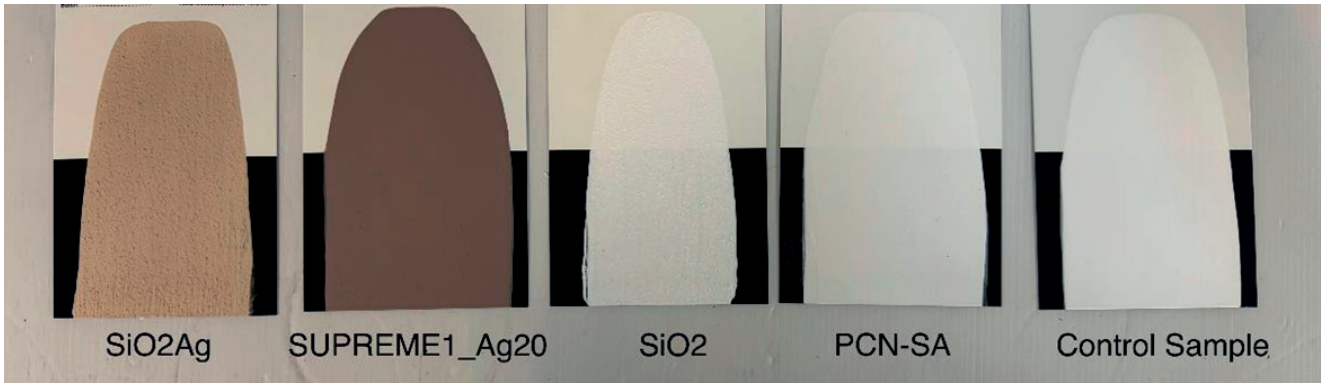

Figure 9 - Black film samples coated with NPs formulation. ISOMAT.

MEASURING WHAT MATTERS: ENVIRONMENTAL FOOTPRINT IN FOCUS

Significant progress has been made in assessing the environmental impact of SUPREME's advanced materials. TECNALIA completed a comprehensive evaluation for the different nanomaterials under investigation, including a hotspot analysis to identify the processes and raw materials that contribute most to environmental impact.

The assessment also considers the broader coating composition , including polylactic acid, bio-silicone and bio-polyurethane, which make up the majority of the final product and help reduce its overall footprint. Early findings reveal that although nanoparticles account for only 2–5 wt% of the coating, they dominate the environmental impact. This insight provides clear direction for future improvements and greener production strategies.

"*Our hotspot analysis shows exactly where improvements are needed, allowing us to focus on greening the most impactful parts of the process.*"

– **The TECNALIA Team**

NEXT EVENTS

JOIN US AT THE CIRCULAR, SUSTAINABLE AND BIOBASED COATING CLUSTER WORKSHOP!

Our consortium partner Zhenyu Jason Zhang from University of Birmingham will be speaking at the upcoming Circular, Sustainable and Biobased Coating Cluster Technical Workshop taking place online on 14 April, from 10:00 to 12:00 (CEST).

The event will bring together experts from across the Circular Bio-based Europe community to explore sustainable materials for coatings, including bio-based raw materials such as algae, beet, sugarcane, cellulose and lignin. SUPREME will contribute to the discussion alongside fellow EU-funded projects within the cluster.

We look forward to exchanging knowledge, strengthening collaboration and advancing circular and sustainable coating solutions together!

Register here

STAY CONNECTED!

As SUPREME moves through its final year, we look forward to sharing more milestones, results and impact stories with you.

To stay up to date with our latest developments, events and achievements, follow us on LinkedIn and visit our website for news and project updates.

Let's continue driving sustainable antimicrobial innovation together!

CONSORTIUM

KU LEUVEN BioTeC

PCNano materials

HELLENIC REPUBLIC
National and Kapodistrian University of Athens

NTNU
Norwegian University of Science and Technology

CRF

NEXT TECHNOLOGY TECNOTESSILE
SOCIETA' NAZIONALE DI RICERCA R. L.

PNO INNOVATION

tecnalia
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

WAGENINGEN
UNIVERSITY & RESEARCH

ORYKTON
Exploring Growth Oceans

National Institute for Public Health and the Environment
Ministry of Health, Welfare and Sport

isomat
building quality
for a sustainable future

TRAFI
Creatività Tessile

AkzoNobel

DuPont Teijin Films™
Innovation | Partnerships | Sustainability

FiberLean
Strength by Design

UNIVERSITY OF BIRMINGHAM

#supreme-coating

@supreme_eu_proj

www.supreme-project.eu

CONTACT US

PROJECT COORDINATOR

Jan Van Impe
jan.vanimpe@kuleuven.be

Monika Polanska
monika.polanska@kuleuven.be

Zhenyu Zhang
z.j.zhang@bham.ac.uk

Funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No 101058422.