



Sustainable nanoPaRticles Enabled antiMicrobial surfaceE coatings

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



BREAKING NEWS

Welcome to our third SUPREME Newsletter! This edition will bring you the latest updates and achievements from the SUPREME project! For continuous updates, follow us on [LinkedIn](#) and [X/Twitter](#), or check out our news [website](#) section.

The SUPREME General Meeting in Prato, Italy, hosted by Next Technology Tecnotessile (NTT) and Trafi Creatività Tessile srl (TAFI) in April 2024, was a successful gathering where project partners reviewed progress, discussed future strategies, and aligned on upcoming milestones.



SUPREME Consortium in Prato, Italy

CONFERENCE AT PRISMA IN PRATO



Presentation and conference room in the Meeting Venue at PRISMA (Prato Industrial Smart Accelerator)



Visit to the facilities of Next Technology Tecnotessile (NTT) in Prato, Italy

VISITING TRAFI'S SHOWROOM



Visit to Trafi's Showroom in Prato, Italy



Visit to Trafi's Showroom in Prato, Italy

MAIN TOPIC: SUPREME RESEARCH ADVANCEMENT



In this 3rd edition, we're excited to showcase the latest breakthroughs in the SUPREME project, where the different partners have made significant developments on cutting-edge research in antibacterial nanotechnology. Stay tuned as we continue to push the boundaries of material science and shape the future of sustainable, high-performance coatings.

Next Technology Tecnotessile (NTT)

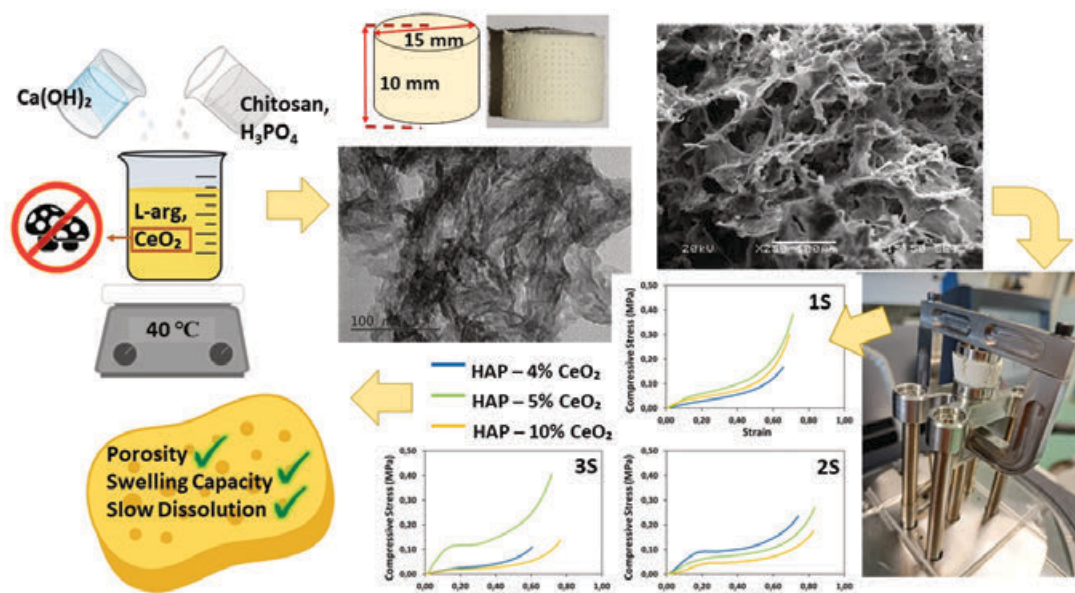
Next Technology Tecnotessile is leading the application of the coating formulations developed in the SUPREME project on textile substrates by using plasma technologies under vacuum and atmospheric conditions. These technologies allow to deposit coatings with tuneable thickness on different substrates with different morphology. In the preliminary phase, NTT and TRAFI have selected the cellulosic and synthetic fabrics type for the experimental activities to be coated with a titanium dioxide nanoparticles (TiO_2) dispersion. Then, after the process conditions optimization, all the samples have been characterized in terms of coating distribution and durability check. NTT has shown the positive effects of the plasma treatment on textiles samples to improve the fabric coating. At the same time, TRAFI has tested two different coating methods in combination with specific chemical agents to get a uniform distribution of TiO_2 nanoparticles for the same fabrics type. The results obtained from the first trials will be used for the next tests and validation at industrial level.

National Technical University of Athens (NTUA)

NTUA's team has successfully synthesized $\text{TiO}_2@Ag$ and $\text{TiO}_2@CuO$ core-shell nanostructures with antimicrobial and photocatalytic properties. These innovative nanostructures address a common challenge in designing feasible (photo)catalysts by expanding the optical response of the core. The core-shell structure of these nanostructures prevents agglomeration and allows for multiple catalytic cycles without intermediate purification, ensuring long-term stability and reusability. Additionally, the materials exhibit antimicrobial properties, expanding their potential applications beyond (photo)catalysis. The techniques developed for synthesizing these nanostructures are eco-friendly by design, safe both for humans and the environment, scalable, making them viable for industrial production. The (photo)catalytic properties of the samples were tested by monitoring model reactions of common aqueous pollutants, methylene blue and 4-nitrophenol spectroscopically. Our materials significantly reduced the degradation time of these dyes, confirming their effective (photo)catalytic behavior. These (photo)catalysts not only achieved rapid pollutant reduction but also proved to be reusable without the

the need for purification between consecutive cycles, reducing the maintenance costs. In collaboration with our partners, we also examined the antimicrobial performance of our nanomaterials. The results revealed that these materials possess antibacterial and antifungal properties, rendering them multifunctional and useful in mitigating the spread of pathogens.

Additionally, NTUA published an article on Nanomaterials entitled “Effect of Nanoceria Suspension Addition on the Physicochemical and Mechanical Properties of Hybrid Organic–Inorganic Hydroxyapatite Composite Scaffolds”, where hydroxyapatite-ceria (HAP-CeO₂) scaffolds were developed with antifungal properties against *Aspergillus flavus* species. The best-performing sample, containing 4% CeO₂, showed enhanced mechanical strength due to the growth of needle-like crystals. These scaffolds also had high porosity and a low dissolution rate, making them promising antifungal bone graft material for potential biomedical applications.



Graphical Abstract

Publication:

Gkomoza, P.; Kitsou, I.; Koltsakidis, S.; Tzetzis, D.; Karydis-Messinis, A.; Zafeiropoulos, N.E.; Gerodimou, F.; Kollia, E.; Valdramidis, V.; Tsetsekou, A. Effect of Nanoceria Suspension Addition on the Physicochemical and Mechanical Properties of Hybrid Organic–Inorganic Hydroxyapatite Composite Scaffolds. *Nanomaterials* 2024, 14, 1102.

<https://doi.org/10.3390/nano14131102>

PCN Materials

PCN Materials has successfully developed a cellulose/TiO₂ compound with potent antiviral properties. Specifically, PCN has incorporated an antiviral substance (PCN-SA), which has been communicated to all partners as the core material. This compound was used to create a cellulose coating on glass

substrates, which were subsequently tested by University of Birmingham. The results showed up to a 3-order-of-magnitude (99.6%) reduction in SARS-CoV-2 infection within just 10 minutes. In our view, this is one of the most significant results achieved by the SUPREME project thus far, particularly due to its relevance in inhibiting a highly significant virus (SARS-CoV-2) on coated surfaces, potentially including high-traffic areas.

TECNALIA

TECNALIA is making significant progress in the environmental life cycle assessment (LCA) of the innovative solutions developed within SUPREME project. To date, we have completed the LCA for the manufacturing process of TiO₂ nanoparticles. This milestone is crucial as these nanoparticles are the basis for the development of advanced core-shell nanostructures and carbon quantum dots (CQDs) decorated TiO₂-based nanoparticles. Furthermore, we are in the process of drafting comprehensive Eco-design guidelines aimed at optimizing the manufacturing processes for the final products. These guidelines are being tailored to a range of materials, including textiles, metals and alloys, ceramics, paper/cardboard, and plastics. By applying these guidelines, we aim to ensure that the production methods not only enhance the functionality and efficiency of the final products but also minimize their environmental impact throughout their life cycle.

University of Birmingham (UoB)

UoB has made research progress to contribute to the general market and economic value analysis on SUPREME products. A market survey on the SUPREME products and applications has been designed in this period. An economic individual framework has been employed in the survey design, that is, the identification of the determinants of individual demand for SUPREME products. The demand is expressed as Willingness to Pay (WTP). The individuals include households and public institutions, such as nursing homes, schools, hospitals, factories, etc., where there are needs for SUPREME products. The direct consumption effect, the child health effect, and the adult health effect as the determinants of WTP in households have been considered, to construct a Contingent Valuation (CV) household survey to study the WTP and collect data. We have selected the national representative sample, researched on the consumers' awareness and knowledge of SUPREME products and have identified the demographic characteristics of end users including age, gender, marital status, family size, education, income, professions, etc. Moreover, the survey questions enable us to investigate consumers' perceptions on the advantages and novelty of the SUPREME products and the corresponding WTP as demand measure. Lastly, the survey outcomes will shed light on the household benefit of SUPREME products and illustrate the differences between household benefits and social welfare. This is crucial for policy making on public health.

INTERVIEW CORNER



Role @SUPREME



Laura Buccoli

University of Birmingham

"I am a researcher associate at the University of Birmingham in Chemical Engineering. I belong to the Surfaces and Interface Group of Supreme Project. My work is focusing on enhancing MFC (Micro Fibrillated Cellulose) coatings for improved mechanical strength and durability across various surfaces. This work aims to decorate efficiently MFC coating with antimicrobial nanomaterials, enhancing the performance of final coating."

Two words that come to your mind when you think about bacteria

"Everywhere & invisible."

How your work @SUPREME will change people's life in the future

"The presence of bacteria poses a significant concern across various domains, from medical settings to everyday surfaces. It's a challenge that everyone must contend with, and despite numerous prevention methods, the spread and diffusion of bacteria, especially pathogens, or the formation of more complex organisms like biofilms, can lead to infections and everyday issues. The focus of the SUPREME project is to find sustainable, long-term solutions that address not just specific areas but are applicable to all highly exposed and high-traffic surfaces and materials. The initial step in challenging infections caused by bacteria and viruses is to impede their growth, thereby limiting their spread. This work will help provide a more accessible, versatile, and practical strategy!"

Three products of every-daylife where SUPREME technology will be implemented in ten years

"Electronic glass, personal textile & packing papers"

INTERVIEW CORNER



Role @SUPREME

I'm Daniele Spinelli, project manager at Next Technology Tecnotessile, the research institute that is involved in the application of antimicrobial/antiviral coating on textiles demonstrators and analysis of their characteristics."



Daniele Spinelli
NTT

Two words that come to your mind when you think about viruses

"Harmful and replication"

How your work @SUPREME will change people's life in the future

"The SUPREME project aims to develop novel antimicrobial, antiviral, and antifungal tailor-made surface nanocoatings with enhanced performances when used on a wide range of substrates and textiles. The production of the SUPREME coatings will follow a sustainable-by-design approach that considers both toxicity and environmental impact from outset to guarantee both market acceptance and sustainability of the overall process whilst having a robust safety assurance in place for human health."

Three products of every-daylife where SUPREME technology will be implemented in ten years

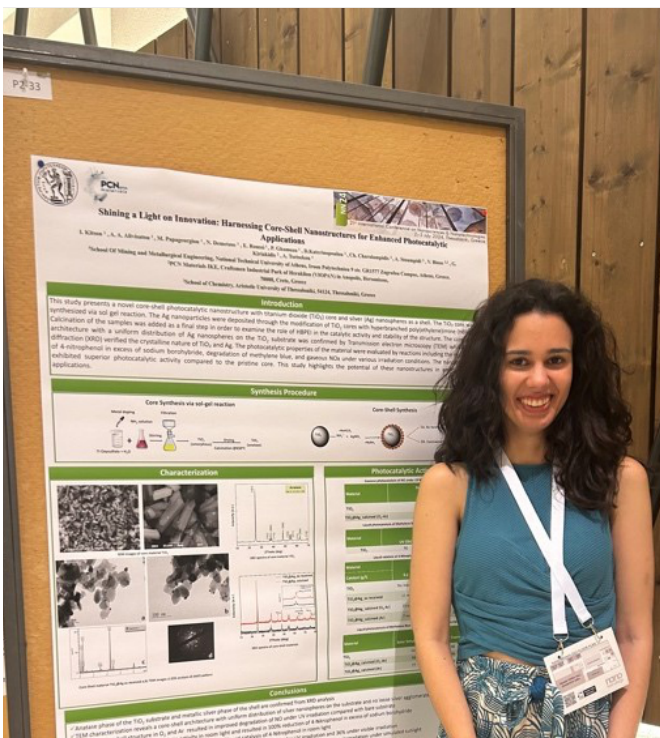
"Fabrics for everyday life and medical textiles, packaging materials (food and non-food) and metals."

WHAT'S HAPPENING?

What? 	Who? 	Where? 	When? 
<u>FOODSIM 2024 - 13TH INTERNATIONAL CONFERENCE ON SIMULATION AND MODELLING IN THE FOOD AND BIO-INDUSTRY</u>	KUL	Ghent, Belgium	7 - 11.04.2024
<u>European Symposium on Surface Science (EMASST)</u>	PCN	Athens	17 - 19.04.2024
<u>International Conference on Nanotechnology for Renewable Materials</u>	UOB	Atlanta, USA	10 - 14.06.2024
<u>MaterialsWeek 2024</u>	RIVM	Cyprus	17 - 21.06.2024
<u>21st International Conference on Nanosciences & Nanotechnologies</u>	NTUA & PCN	Thessaloniki, Greece	29.06 - 06.07.2024
<u>Elements of Future – XXVIII National Congress of Società Chimica Italiana</u>	NTT	Milano	26 - 30.08.2024
<u>10th International Conference on Quality and Safety in food production chain</u>	KUL	Wroclaw, Poland	12 - 13.09.2024
<u>NanoTox 2024</u>	RIVM	Venice	23 - 25.09.2024
<u>ISFA 2024 - International Symposium on Food and Agro-Biodiversity</u>	KUL	Semarang, Indonesia	2 - 4.10.2024



10th International Conference on the Quality And Safety In Food Production Chain – Jan Van Impe presenting the SUPREME project – Wroclaw, Poland







NANOTECHNOLOGY 2024 – Poster presentation by Foteini Gerodimou – Thessaloniki, Greece



ISFA 2024 International Symposium on Food and Agro-Biodiversity – Jan Van Impe presenting the SUPREME project – Semarang, Indonesia

WHAT'S NEXT?

What? 		Where? 	When? 
<u>Athens Conference on Advances in Chemistry</u>	NKUA	Athens	06 – 08.11.2024
<u>SCI Formulation Forum</u>	UOB	London	21 – 22.01.2025
<u>European Symposium on Computer Aided Process Engineering (ESCAPE I 35)</u>	KU Leuven	Ghent, Belgium	06 – 09.07.2025

Looking forward to SUPREME Newsletter # 4 in March 2025!

CONSORTIUM



#supreme-coating



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