

Sustainable, therapeutic footwear (antimicrobial, self-cleaning), biodegradable, with reduced carbon footprint, S-SHOE

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The purpose of the project

The S-SHOE project aims to digitally design and manufacture sustainable, therapeutic footwear for people with diabetes, using advanced materials—antimicrobial leather with self-cleaning properties—and the principles of circular eco-design.

The motivation is urgent: globally, 537 million adults have diabetes (IDF, 2021), with an estimated lifetime prevalence of 19–34% for foot ulcers, given that the risk of amputation is 30–40 times higher than for healthy individuals.

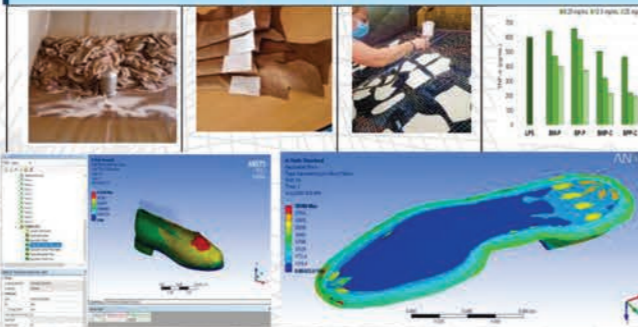
Addressing these clinical and environmental challenges, S-SHOE integrates eco-friendly materials, custom design based on individual biometric parameters, and numerical simulation of wear behavior into a coherent concept for an innovative product with a low carbon footprint

Objectives of Phase I

- Development of eco-design methods for sustainable therapeutic footwear and a sustainability analysis model
- Development and validation of technologies for eco-friendly, biodegradable leathers and leathers with antimicrobial and self-cleaning finishes
- Finite element analysis (FEA) and simulation of the wear behaviour of the foot–shoe assembly
- 3D digital design of custom shoe lasts based on biometric measurements from 10 patients with diabetes
- Validation of the safety of new materials (toxicological and environmental testing)
- Dissemination of the project through participation in trade fairs, conferences, undergraduate theses, and articles submitted for publication.

Key results achieved

The eco-friendly leathers were produced by replacing chromium salts with composites containing collagen and keratin hydrolysates, achieving a biodegradability rate of 72.4–89 % after 21 days, compared to 37.2% for conventional leathers. The surface finish of the leathers provides antimicrobial activity and self-cleaning properties, which ensures additional protection for the diabetic foot.



Biodegradable and durable leathers, antimicrobial coating, anti-inflammatory testing, digital design for people with diabetes

- ◆ 6 types of biodegradable eco-leather
- ◆ 3 types of antimicrobial self-cleaning leather
- ◆ 89% biodegradability vs. 37% for conventional leather
- ◆ Digital design of sustainable shoe last models

- Self-cleaning properties: 50% degradation of the simulated stain after 240 minutes of exposure to visible light
- LCA analysis (ISO 14040): significantly reduced environmental impact compared to the conventional process across all ECOINDICATOR99E categories
- 3D virtual models and physical lasts adapted to the anatomy of the diabetic foot, based on individual biometric data
- Toxicological testing (MTT, ELISA): non-cytotoxic materials with anti-inflammatory effects on the samples tested
- Dissemination: 3 ISI/BDI articles, 1 silver medal (Euroinvent 2025), participation at 12th TexTeh Conference, 38th IULTCS Congress, project website.

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THE TECHNOLOGIC AND BUSINESS INCUBATOR ITA TEXCONF

ITA TEXCONF is an entity in the infrastructure of innovation and technological transfer without legal personality, established within INCDTP based on HG 406/2003, accredited for the Bioeconomy, Advanced functional materials and Environment and eco-technologies fields, Certificate no. 169/2026, issued by the Ministry of Education and Research.



ITA TEXCONF is part of the National Network for Innovation and Technology Transfer ReNITT and acts for the sustainable economic and social development of the textile sector, by ensuring access to technological performance, developing the innovative environment, introducing quality systems and developing human resources.

The incubator is involved in specific actions of collaboration with all 5 existing clusters in the textile field, of which it is part as an active member: Romanian Textile Concept Cluster – RTxC, ASTRICO NE, Traditions Manufacture Future, Transilvania Textile & Fashion Cluster and Fashion Future Cluster.

Services:

- ❖ Services of sustaining textile-clothing SME competitiveness within the competition background of the market economy;
- ❖ Services aiming at creating partnerships and financing drawing in within the projects;
- ❖ Services aiming at the product, equipment, innovation technology promoting in the field of textile-clothing, as part of scientific events (fairs, symposiums, conferences, etc.);
- ❖ Mediating contracts of technology transfer/manufacturing of products, experimental models, prototypes and specific applications for technical textile, personal protective equipment, invasive and non-invasive medical devices, special-purpose items, etc. ;
- ❖ Mediating contracts in the field of investigating the textile material and product properties, within the RENAR accredited INCDTP laboratories.

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