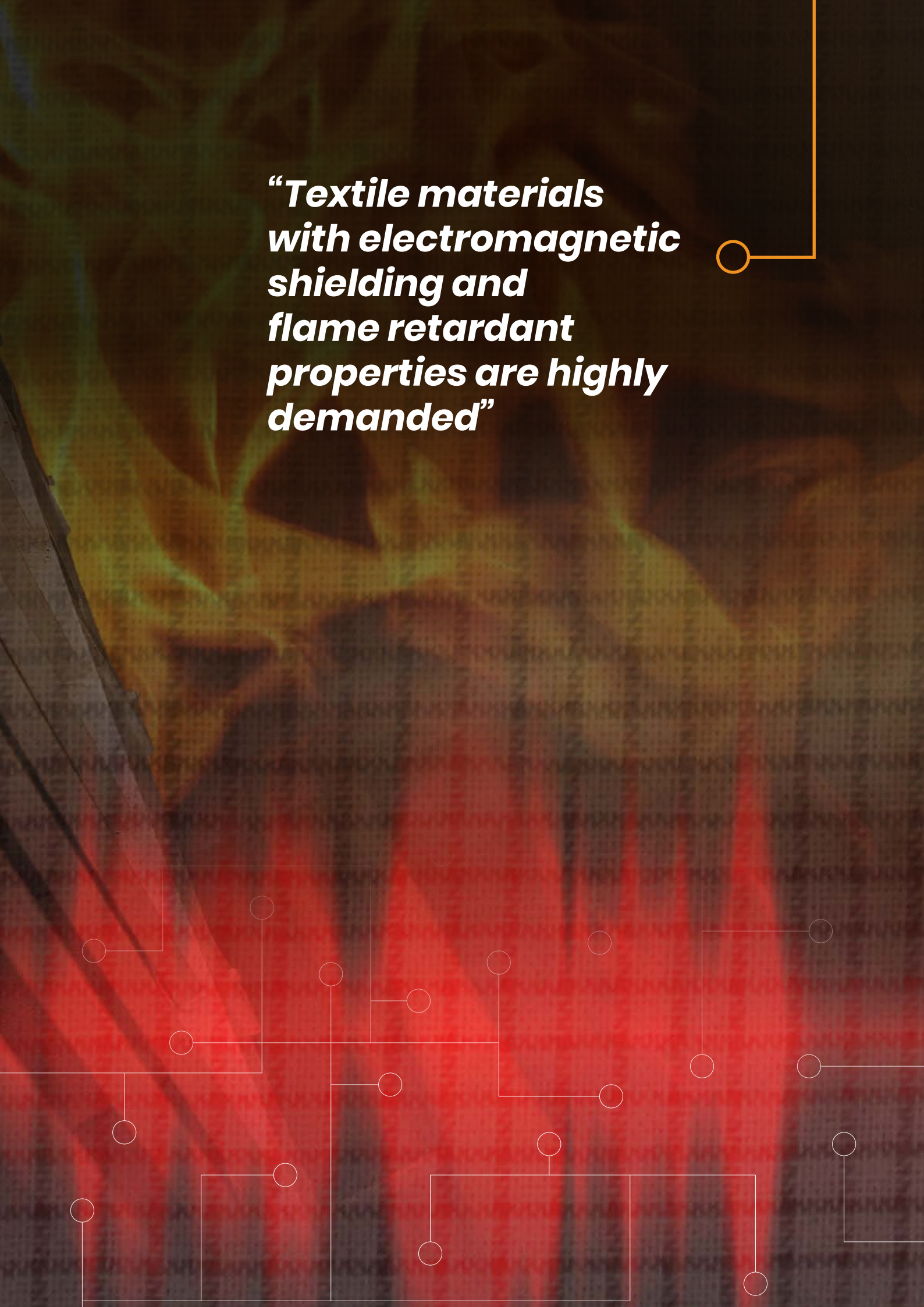


“Textile materials with electromagnetic shielding and flame retardant properties are highly demanded”

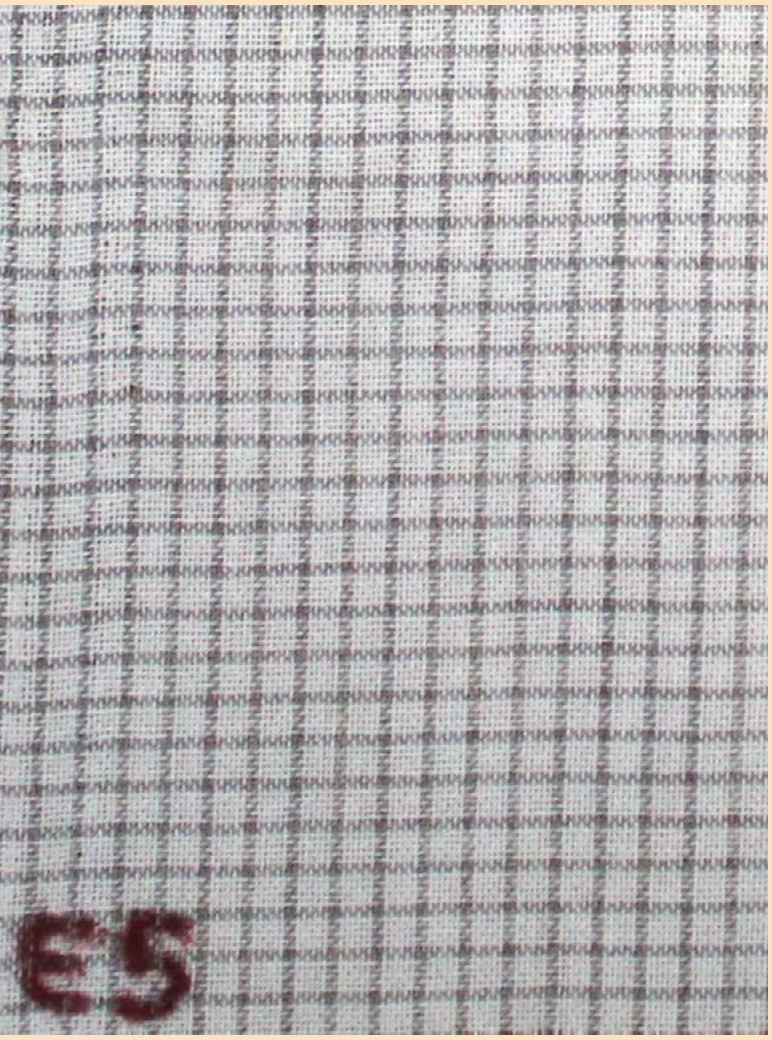
TexEMFiRe

Manufacturing textiles with electromagnetic shielding and fire retardant properties by plasma based methods

Innovative textile materials can solve global societal challenges such as reducing energy usage, water wastage and material consumption. In addition, textiles that have been smartly modified open doors to a wide variety of new industrial products and applications. In the Manunet project 'TexEMFiRe', a collaboration between the partners National Institute for Lasers, Plasma and Radiation Physics (INFLPR, Romania), The National Research-Development Institute for Textiles and Leather (INCDTP, Romania), SC Majutex SRL (Romania), Tecnolab del Lago Maggiore (Finpiemonte, Italy) and Università degli Studi del Piemonte Orientale (UNIUPO; Finpiemonte, Italy) have carried out research into the development of innovative textile materials with improved electromagnetic shielding and flame retardant properties. Bogdana Mitu, project leader of the consortium and affiliated with the National Institute for Lasers, Plasma and Radiation Physics: "With this project we are focusing in particular on the Buildtech sector. In this sector, it is important that technical textile materials that are used have different functions, such as electromagnetic shielding and fire retardant properties. In our project, we have demonstrated the working principle by using eco-friendly plasma-based techniques that work under low and atmospheric pressure."

Less materials, more flexibility

"In the project, we started from the basic idea of generating as much flexibility and functionality as possible with the use of fewer materials," says Mitu. "Our approach therefore focused on the utilization of various thin film deposition techniques, processes in which thin coatings are deposited on a substrate material. We manufactured the textile material from classic yarns such as cotton and polyester. By integrating yarns containing metal fibres or metal coated yarns, we have been able to develop a basis electromagnetic shielding. This is significantly enhanced by plasma deposition of metallic layers onto the surface. For the fire retardant properties, we made use of atmospheric pressure plasma system and apply an additional coating of special resin, also containing nanoadditivated LDH. Although quite some research has been done into the integration of these separate functionalities in textiles, the combination of both properties has not yet been studied. This is where the innovative character of our project reveals itself. In addition, through the use of plasma-based techniques, instead of chemical processing, we do not produce water waste, which is normally a problem in the textile industry."



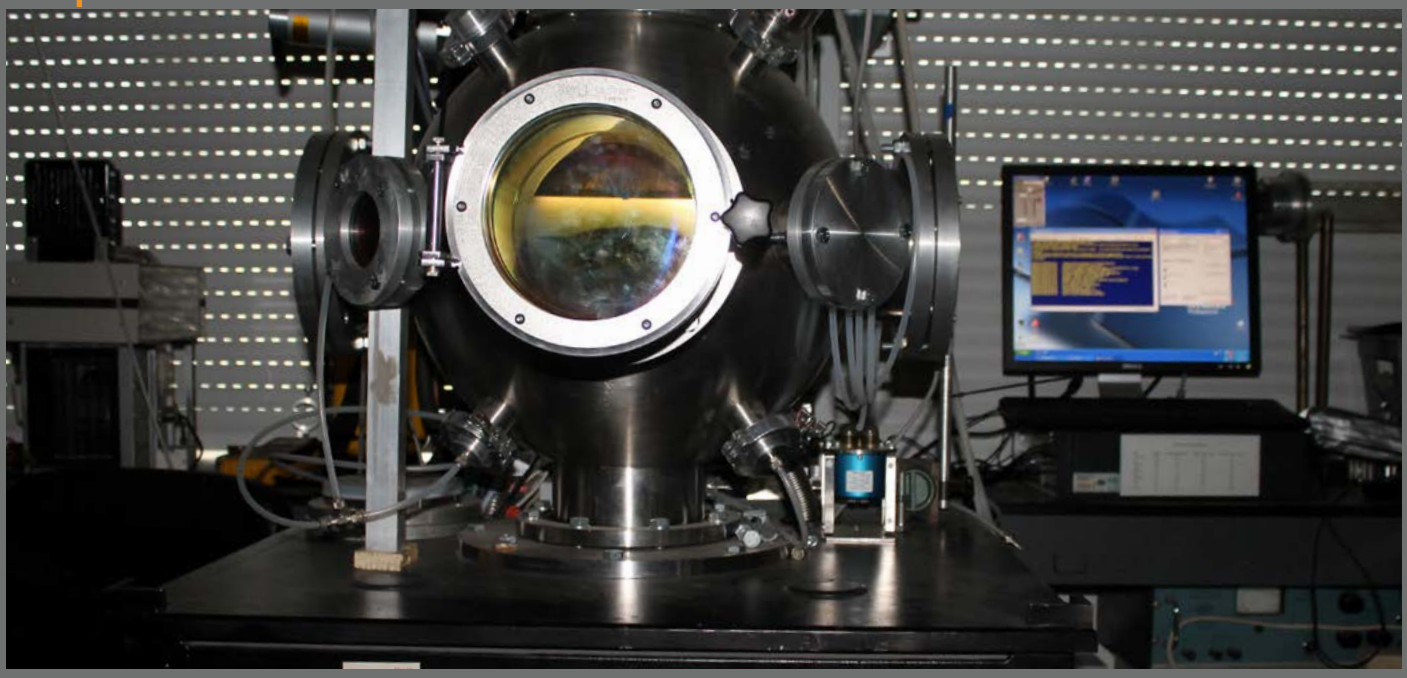
Wide range of industrial applications

"We were confronted with quite a few technical challenges in the project. Increasing the deposition area on surfaces relevant to the industry posed the biggest challenge. Although producing small samples was relatively simple, it was more complicated to produce larger samples. Within the industry, innovative textile materials with electromagnetic shielding and flame retardant properties are highly demanded. After all, many companies want to protect their expensive equipment and installations against electromagnetic radiation that can potentially cause damage. In order to achieve this, both sensitive equipment and radiant equipment can be packed with a protective and damping coating. Modified textiles may also be interesting for military applications. You can imagine that in certain missions it is important that military staff have clothing that is fire-resistant. This contributes to the prevention of serious injuries."

Protection against electromagnetic radiation

Research shows that electromagnetic waves from the environment can also be harmful to very young children. According to Mitu, protection against electromagnetic radiation is also essential for vulnerable groups such as patients with Alzheimer's and other neurological diseases. Innovative textile materials with electromagnetic shielding and flame retardant properties can also be a solution for private use in the home. "An example is the application in curtains. If curtains are fitted with a radiation-resistant coating, vulnerable interior spaces and residents can be shielded against radiation from, for example, Bluetooth, Wi-Fi and 5G transmission masts. The most important application of our development, and also the market that ultimately offers us the greatest commercial opportunities, is the clothing industry. At the moment there is still little supply of clothing that offers protection against electromagnetic radiation as well as flame retardant properties. For people who wear a pacemaker because of heart problems, for example, it is important that there is no interference between the medical device and radiation objects such as a smartphone. If the operation of a pacemaker is disturbed by electromagnetic radiation, this can of course have unpleasant consequences for the wearer."

Depunere
Magnetron



Samples coated with fire retardant layer tested for fireproofing

Less impact on the environment

“Our project has enabled us to boost the development of a new class of innovative coatings,” Mitu emphasizes. “Various valuable quantitative information about the plasma deposition process, properties such as electromagnetic shielding and flame retardancy were analysed in the Life Cycle Assessment, which was specially developed during the project, and compared to classical processes. After all, it was important for us both to minimize the impact on the environment and to achieve a cost reduction. The use of chemicals is usually a major problem in industrial processes. In most cases, large quantities of chemicals are used to generate fire retardant properties. In addition to the fact that this is of course bad for the environment, it is also the case that many of these chemicals will be banned at European Union level in the coming period. The design of a new method based on plasma techniques is therefore essential to reduce the amount of chemicals and identify alternatives. The other advantage of the developed method is a reduction of waste water. If you look at the production of modified textiles, it is worrying to see how much wastewater is released. With our method we show that on the one hand we are able to use less chemicals in the industrial process and on the other hand we can reduce the amount of waste water to a minimum.”

Excellent division of tasks in consortium

Especially for this project a relatively broad Romanian-Italian consortium has been developed, consisting of SMEs, universities and research institutes with a lot of experience in the production of textiles, research on modified materials and testing. “We have divided the tasks well from the start,” Mitu states. “The universities and national institutes have focused on the application of plasma techniques and nano-additives for obtaining fire retardant properties and electromagnetic shielding, as well as on the characterisation of modified textiles. The Institute for Lasers, Plasma and Radiation Physics, where I work, had the task to obtain improved electro-magnetic shielding, and to make depositions based on silicon dioxide for fire retardancy. The National Research-Development Institute for Textiles and Leather was responsible for conceiving the textile structures and measuring and determining textile properties, like yarns dimension and density. In addition, Tecnolab del Lago Maggiore provided us with an accredited laboratory that could be used for specific measurements of electromagnetic shielding and testing the resistance to fire. Università degli Studi del Piemonte Orientale focused on the design of nanoadditivated resins and the Life Cycle Assessment. The textile company SC Majutex SRL contributed by providing the necessary textiles that were produced according to calculations and took the responsibility to think about a business plan and further commercialisation. It is a good starting point to think in advance about the costs of implementing our methodology in the companies and what exactly the benefits are.”

Sustainable cross-border cooperation

"With the results of the approach developed in the consortium, we have been able to expand the diversity of applications of modified textiles in industrial practice and give a boost to a strong economic and academic valorisation. We are now preparing a common research paper based on the results obtained during the project. We are also currently considering patent applications and the proposal of a follow-up project with the same consortium, which will focus on coatings for antimicrobial and antiviral applications. The Manunet project has enabled the consortium to discover new possibilities and new expertise in the field of textile processing. Before the Manunet project, we did not yet know our partners. Both during the formation of the consortium and during the various meetings, we experienced the full support of the Romanian and Italian funding agencies. Moreover, the great advantage of Manunet in general is that the consortium does not have to be very large. This has a positive effect on the interactions and connectivity. Our Manunet project has led to a sustainable collaboration."

Bogdana Mitu

Acronym
TexEMFire

Call
Call 2017

Coordinating Funding Agency
UEFISCDI

Participating partners
National Institute for Lasers, Plasma and Radiation Physics (Romania)
The National Research-Development Institute for Textiles and Leather - Bucharest (Romania)
SC Majutex SRL (Romania)
Tecnolab del Lago Maggiore s.r.l. (Finpiemonte, Italy)
Università degli Studi del Piemonte Orientale “Amedeo Avogadro” (Italy)

Project duration
24 months

Total project cost
€ 469.450

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"As funding agency 'Finpiemonte' we have been actively involved in the support and monitoring of the TexEMFiRe project. The communication with both italian and transnational partners went smoothly and we are very pleased with the successful innovation process of the beneficiaries"

Enrica La Martina - FINPIEMONTE S.p.A

"UEFISCDI funds projects with innovative research on how to solve global societal challenges. TexEMFiRe is a good example in the field of innovative textile materials with improved electromagnetic shielding and flame retardant properties, textiles which will be used in a large variety of industries."

Nicoleta Dumitrache - UEFISCDI