ConCoTex

Microsized Conductive lines and structural Coloration on Textiles

Programm / Ausschreibung	COIN, Kooperation und Netzwerke, COIN Netzwerke 12. Ausschreibung	**Status**	abgeschlossen
Projektstart	01.01.2021	**Projektende**	30.06.2023
Zeitraum	2021 - 2023	**Projektlaufzeit**	30 Monate
Keywords	conductive textiles; structural coloration; laser; nanoparticles; electronic textiles		

Projektbeschreibung

The project addresses the potential market of e-textiles and textile coloration. The main target of the project is to develop an innovative and robust bottom-up process that will enable miniaturized conductive patterns in textiles without sacrificing their comfort and stretchable properties. A secondary goal of the project will be the generation of visible structures, structural coloration or machine-readable patterns through laser-induced nanoparticles and micro-structuring surfaces. To achieve these goals the cooperation of a multidisciplinary consortium with experts in the field of textile chemistry and textile physics, laser and microtechnologies, printing technologies, textile manufacturing, and electronic engineering is required. The consortium formed by the 2 research partners UIBK and FHV; the 3 small enterprises DREM, INSOMNIA, TEXETIT; and the 2 large enterprises WOLFORD, and ADRESYS, accomplishes the requirement for the multidisciplinary pool of experts. The adopted methodology will be the following: (1) Development of microsized (10 µm in width or smaller) conductive lines on textiles of high electrical conductivity, while maintaining textile comfort and stretchability. This will be achieved by localized metallization on textiles via confined copper electroless deposition initiated from laser-induced Ag seeds. (2) Generation of visible structures, structural coloration or machine-readable patterns on textiles. This will be achieved by the generation of plasma and laser-induced optical diffraction patterns on textiles, and optimization of the plasmonic scattering effect through control of nanoparticle sizes and their positions on textiles. The project will be organized in six workpackages (WPs). WP1 is about the project management. WP2 is centered on the system development - Silver nanoparticle formation and adhesion on textiles. WP3 is focused on the generation of structural coloration. WP4 is related to the generation of conductive lines and surface passivation. WP5 is focused on the characterization and evaluation. Finally, WP6 is in charge of the dissemination and demonstrators. The outcome of the project will be of significant value for the development of miniaturized electric circuits in the emerging market of e-textiles. In particular the use of miniaturised low energy consuming devices and concepts of energy harvesting will be based on the availability of techniques to produce electrical circuits in 10 µm dimensions or smaller. The expected outcome of the project will also open new routes for applications of laser-modified surfaces in flexible textile structures. The first step into the market will be using small area applications, such as security labelling and asset identification.

Abstract

Electronic textiles (E-textiles) represent one of the high-valued products with major diversity of potential markets, from home care and medical, wellness, security and safety, sports and fitness, leisure, communication to technical applications. However, current technologies available for the production of electrically conductive textiles present limitations in combining the desired electrical conductivity, with the integration of complex architectures of electronics and sensors in stretchable, comfortable textiles. This restricts the full development of e-textiles, and most of its potential markets are still unexploited. Our project target is to develop an innovative robust methodology that will allow the production of complex conductive networks on stretchable textiles with conductive line widths of about 10 µm, smaller than the widths available with the current technologies (30-100 µm). This new approach is focused on a bottom-up process, where a copper conductive layer is formed via electroless deposition from localized laser-induced silver seed nanoparticles. The outcome of this project will permit the formation of miniaturized circuits for sensors and power transmission lines on textiles without sacrificing their comfort and stretchability. As a result of the intensive nano-sized surface structure formed during the laser process visual effects, structural coloration and machine-readable patterns are expected to appear. This can also provide new routes for colouring, and new designs of labelling and asset identification. This is of great interest for the textile dyeing industry, since structural coloration offers an alternative to avoid toxic synthetic dyes, and mitigate water consumption issues related to traditional dyeing.
The European and in particular the Austrian textile industry could take the lead in these potential markets due to their technological experience and know-how. For a higher competitiveness, a rethinking of smart devices and processes to overcome the barriers of the available technologies is required. To this purpose, our consortium formed by companies and research institutions in the field of textiles, laser and printing technologies, and electronics will provide the necessary interdisciplinary actors to create a bridge between the required application-dependant functionalities, and the technical obstacles to overcome for the manufacturing process.

Projektkoordinator

- Universität Innsbruck

Projektpartner

- INSOMNIA Scheffknecht, Peitler OG
- Heinz Mehrrath Textiletiketten e.U.
- Drexel Embroidery GmbH
- Adaptive Regelsysteme Gesellschaft m.b.H.
- Wolford Aktiengesellschaft
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