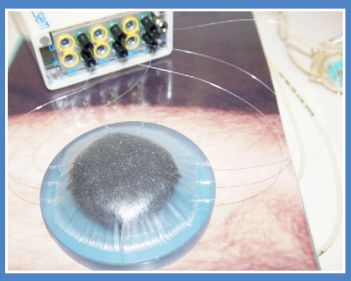
Prof. Gerhard Tröster, ETHZ

TecInTex

TECHNOLOGY INTEGRATION INTO TEXTILES: EMPOWERING HEALTH



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What it's about…

Designing and testing textile based sensors for pressure ulcer prevention and peripheral vascular disease prediction.

Context and project goals

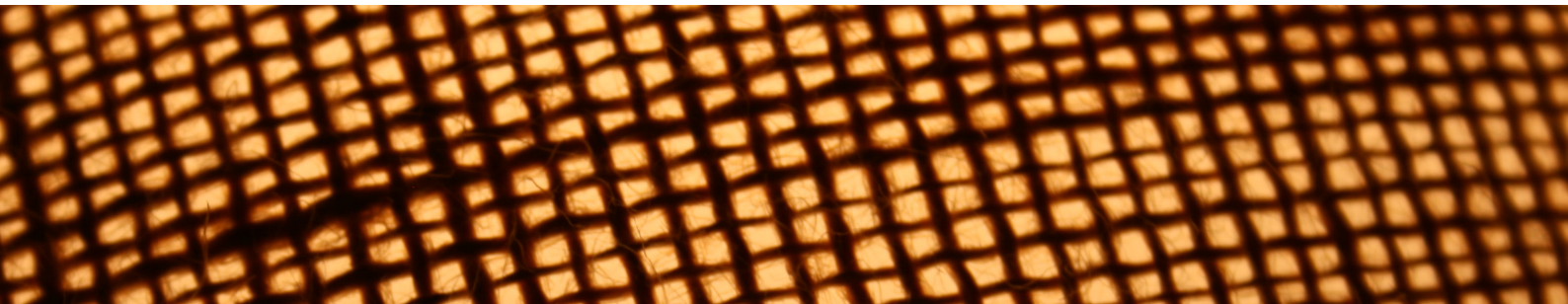
TecInTex aims at the development of truly textile-based advanced (electrical or optical) fibers incorporating sensors, signal transmission or other active components based on nanotechnology. A textile-based Near Infrared Spectroscopy fabric and an intelligent underwear for paraplegics demonstrate the functionality in a clinical setup.

How the project differentiates from similar competition in the field

Designing and manufacturing wearable sensors is a new field of study and their functionality has rarely been demonstrated in clinical environment until now. To the team's knowledge, wearable sensors have neither been used for prediction of pressure ulcer development nor for skeletal muscle (i.e. calf muscle) oxygenation measurement in clinical environment. Any success in prediction of such situations could improve the quality of life in paraplegics and subjects with high risk of Peripheral Vascular Disease (PVD).

Quick summary of the project status and key results

Functionalized e- and o-fibres have been tested in textile fabric. Including micron-submicron selective coating on metallized fibres. Humidity and pressure sensing functionalities have been demonstrated on textile fibers integrated into functional fabrics. Optical fibers for biosensing have been developed for pH and protease activity detection. A prototype has been designed and developed, including connections, electronics and signal processing. It is possible to monitor pH and protease activity with 6 optical fibres simultaneously (3 for pH and 3 for proteases). Sensorized fabrics were tested on body and on wound model. TFT circuits on plastic achieve cut-off frequency around 1 MHz without degradation after 1000 bending cycles. The components and technology for the NIRS demonstrator are approved for the textile integration and clinical testing.



Success stories

Demonstration of pH sensing plastic optical fiber on wound simulator. Demonstration of smart underwear with sensors and wireless electronics. Platform for CSEM participation in European project SWAN-iCare.

Building up a strong consortium for a CTI project with the goal to produce luminous textiles for phototherapy. The consortium consists of a fibre producer, an embroidery company, a company focusing on optical devices for phototherapy and of a clinical partner.

Successfully measuring Oxygenation on the Gastrocnemius muscle of 10 healthy subjects using the newly developed, textile based NIRS system.

Collaboration with Swiss Paraplegic Center in Nottwil. Collaboration with Dr. Med. Anke Scheel from Swiss Paraplegics Center

Three PhD theses at ETH strongly related to TecInTex have been submitted and partly finalized in the last year.

The paper entitled "Flexible a-IGZO TFT amplifier fabricated on a free standing polyimide foil operating at 1.2 MHz while bent to a radius of 5 mm" has been accepted at the 2012 International Electronic Device Meeting, IEDM, the top conference in microelectronic devices.

Presence in the media:

- TTC - Le monde selon Johnson - 29.10.2012. Le tissu intelligent Le maillot de sport avec des fibres optiques et électrodes pour mesurer le rythme cardiaque. La technique est développée par le Centre de microtechnique de Neuchâtel. La fabricante de l'entreprise Smartex, Rita Paradiso, explique comment on utilise le T-shirt. Le centre CSEM a développé aussi des pansements intelligents. Explications de Stéphanie Pasche, CSEM
- TV (14.03.2013: SRF1; 17.03.2013: SF Info; 12.05.2013:3Sat): „Kunstfasern – leuchten, leiten, filtern"
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Main publications

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N. Münzenrieder, L. Petti, C. Zysset, T. Kinkeldei, G.A. Salvatore and G. Tröster, Flexible Self-Aligned Amorphous InGaZnO Thin-Film Transistors With Submicrometer Channel Length and a Transit Frequency of 135 MHz, Electron Devices, IEEE Transactions on, 60, 9, 2815-2820, 2013

N. Münzenrieder, C. Zysset, L. Petti, T. Kinkeldei, G.A. Salvatore and G. Tröster, Flexible double gate a-IGZO TFT fabricated on free standing polyimide foil, Solid-State Electronics, 84, 198–204, 2013

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