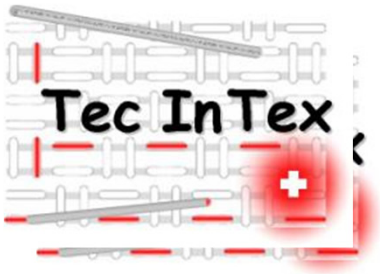


nano-tera.ch

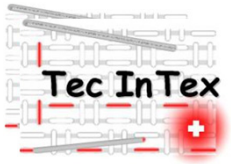
TecInTex:

Intelligente Textilien

Technology Integration into Textiles: Empowering Health

Gerhard Tröster

Zürich, 25. März 2014



Struktur

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

EMPA
Materials Science & Technology

- Partner
  - ETH Zürich Electronics Lab (G. Tröster, G. Salvatore)
  - EMPA St Gallen, Dübendorf (R.Rossi, M.Heuberger, F. Clemens)
  - CSEM Neuchatel (G. Voirin, J. Luprano)
  - University Hospital Zurich (M. Wolf)
  - Paraplegic Center Nottwil (Anke Scheel)
  - Industrie
- Laufzeit
  - 4 Jahre, 2009 - 2013

csem centre suisse d'électronique et de microtechnique

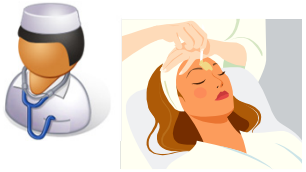
University Hospital Zurich

Swiss Paraplegic Centre

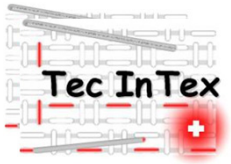
Ziele

Basismodule für den Entwurf und die Herstellung von Sensoren und Aktoren in Textilien

... von der Faser bis zur Anwendung



Evaluation

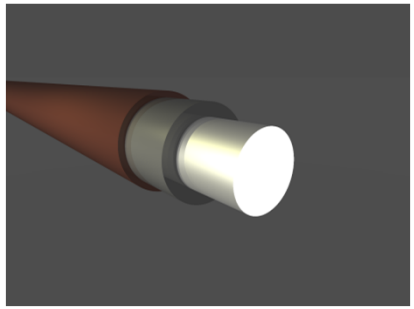


Resultate

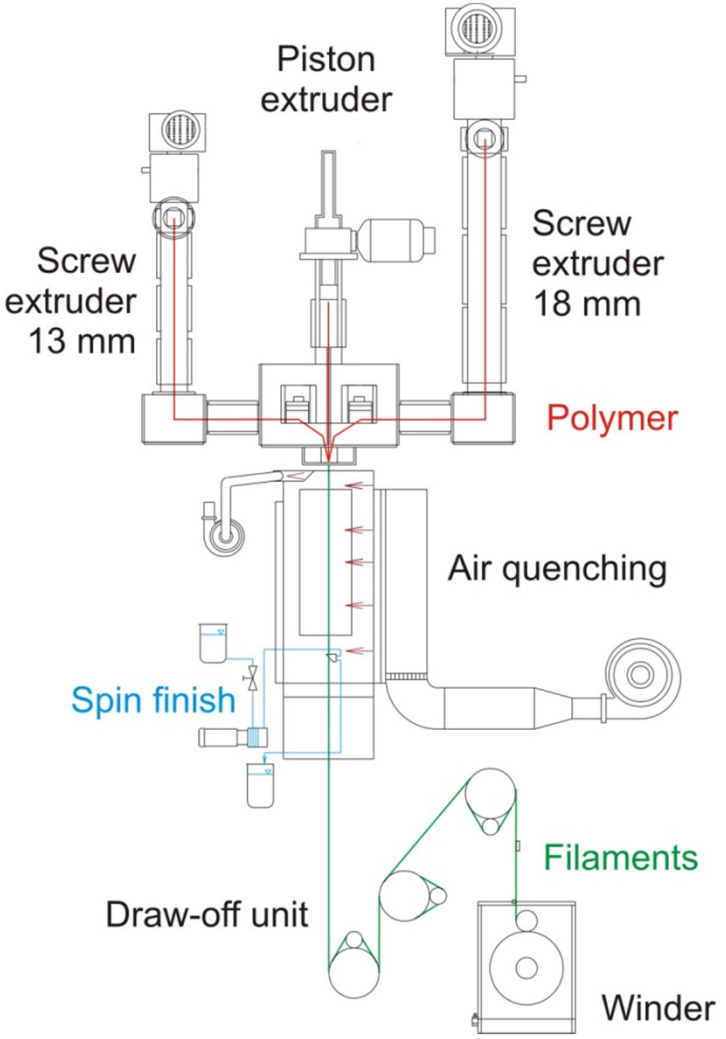
- neue elektrische und optische Fasern, die empfindlich auf Flüssigkeiten, Dehnung, Druck, Kraft reagieren
- neue Gewebe, die Temperaturen und Feuchtigkeit messen können, die riechen, leuchten, rechnen und kommunizieren können

- textile Rollstuhleinlage für Querschnittsgelähmte
- Infrarotspektrometer NIRS (Near Infrared Spectroscopy) im Strumpf zur Bestimmung der Sauerstoffsättigung im Blut

Faserherstellung



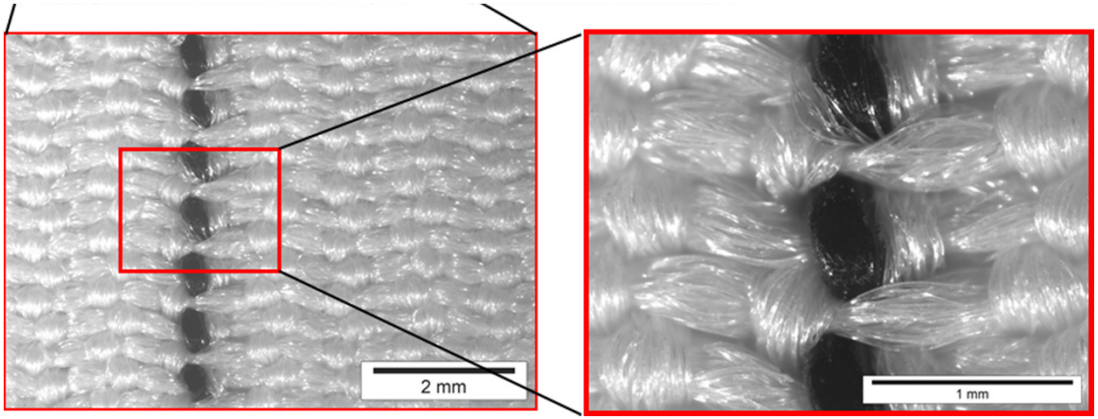
Spider:

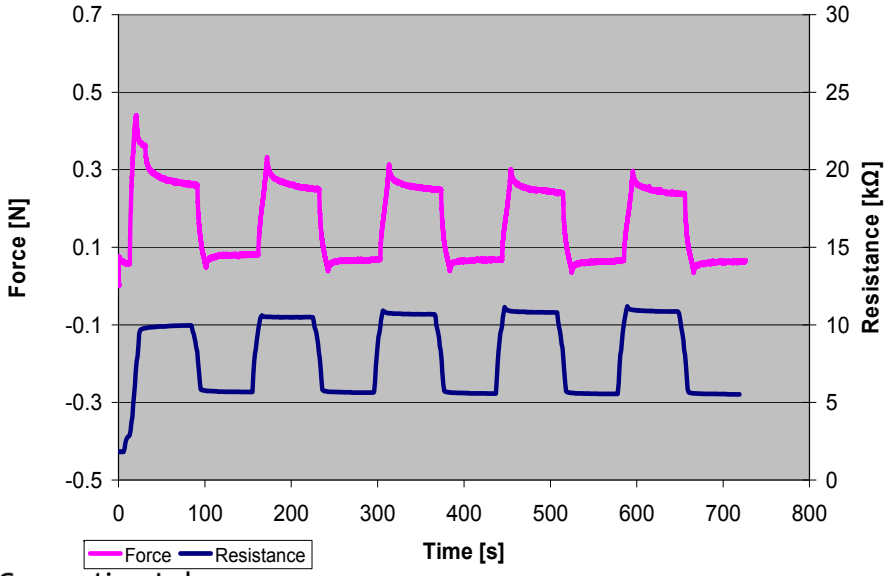


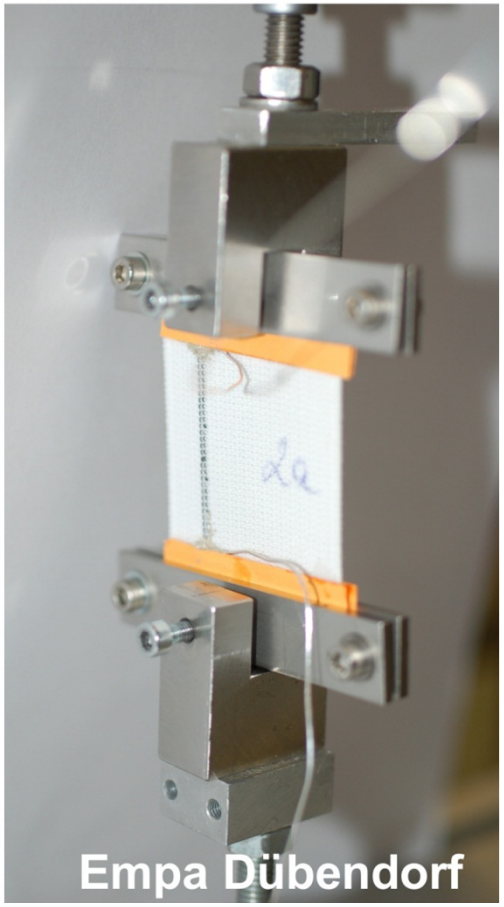
-drei Extruder:

-> 2 Ummantelungen möglich

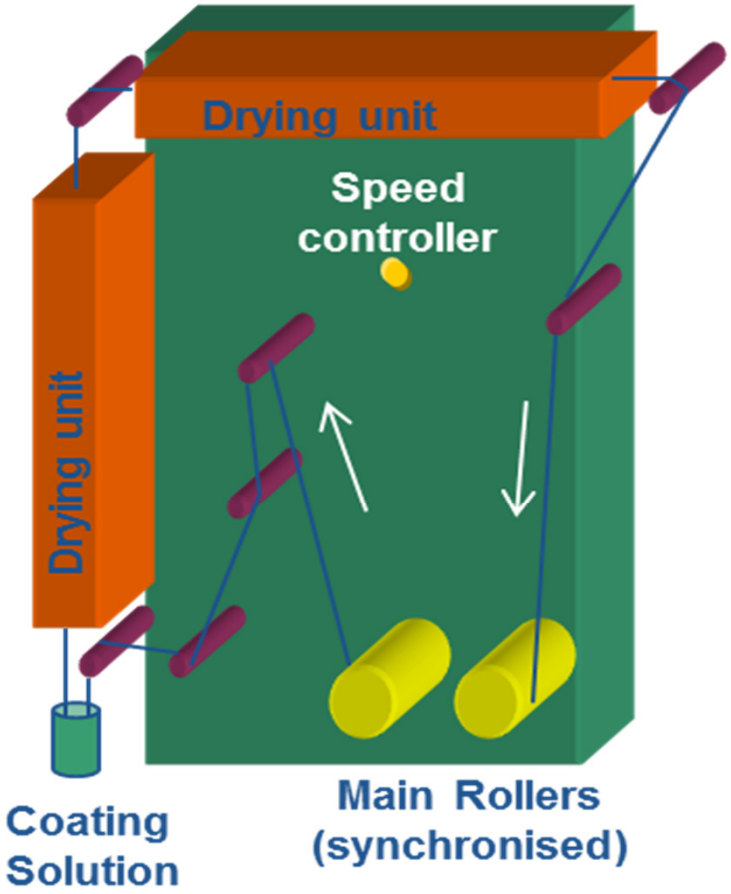
Piezoresistive Fasern: Dehnungssensor

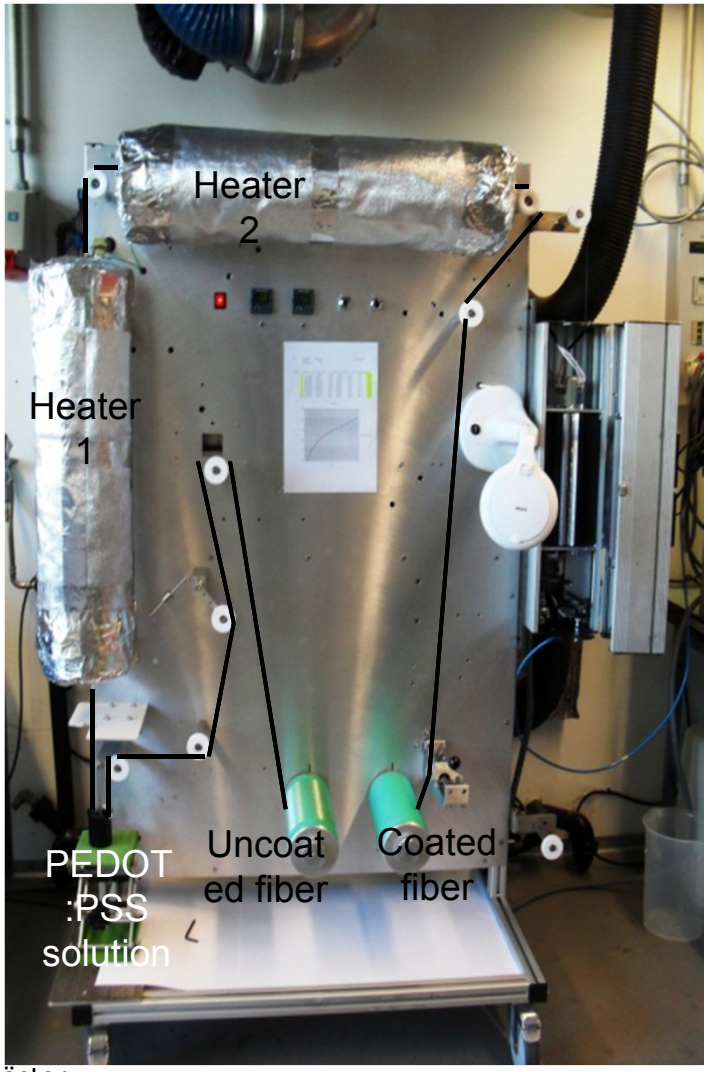




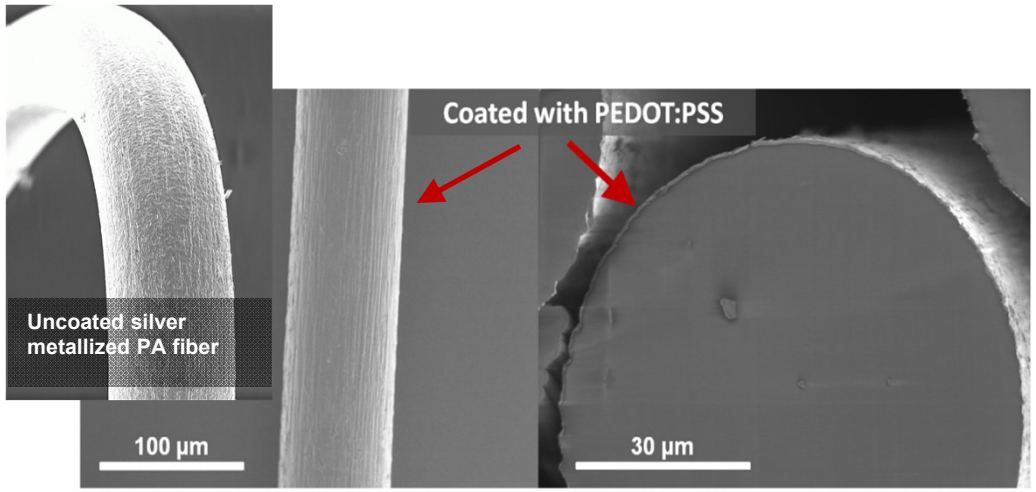


PEDOT:PSS Beschichtung auf metallisierten Fasern



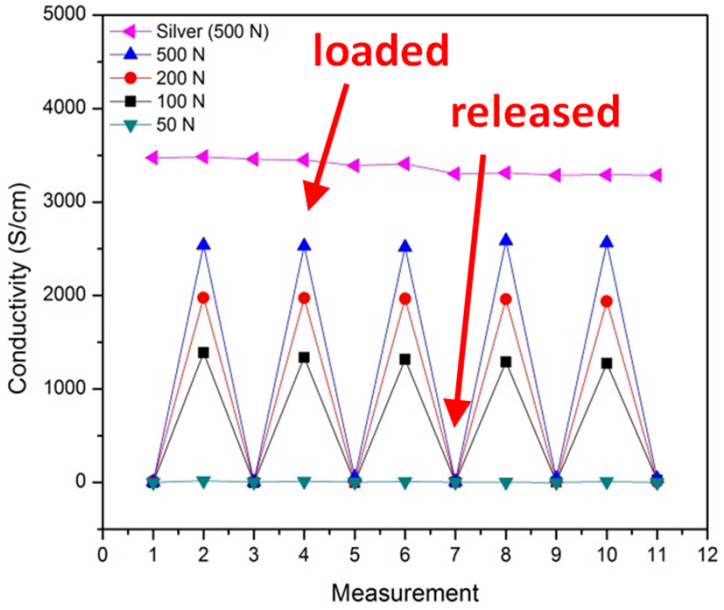


E-Fasern: Drucksensor



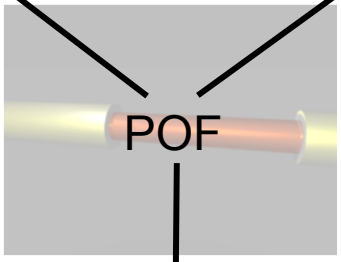
PEDOT:PSS Film auf Silber beschichteter Faser.

1 Lage PEDOT:PSS
300 nm Dicke



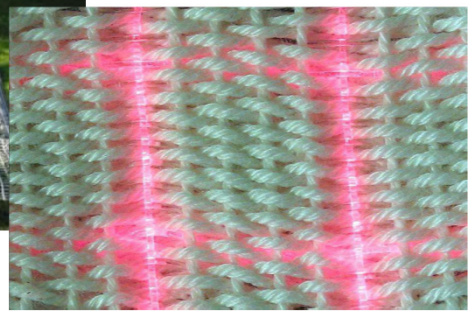
Optische Fasern: POF Optische Fasern aus Polymere

Therapie



Beleuchtung

Sensoren



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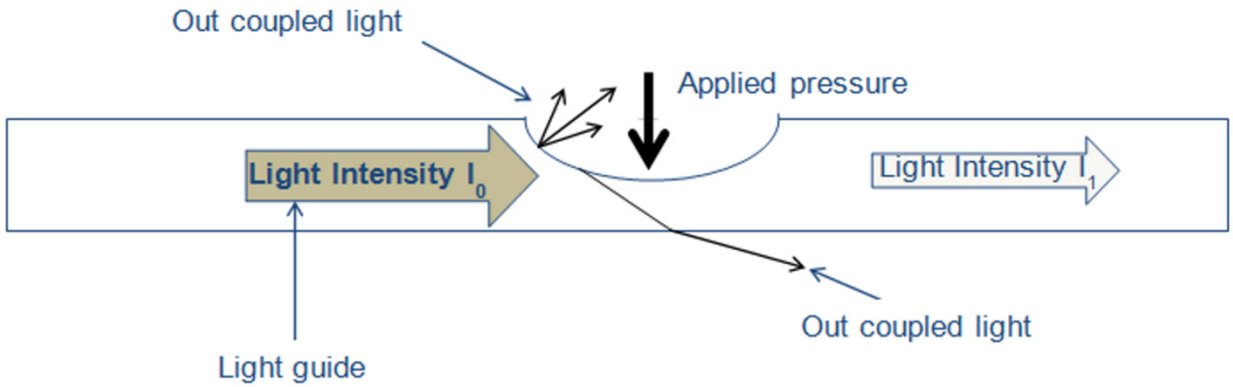
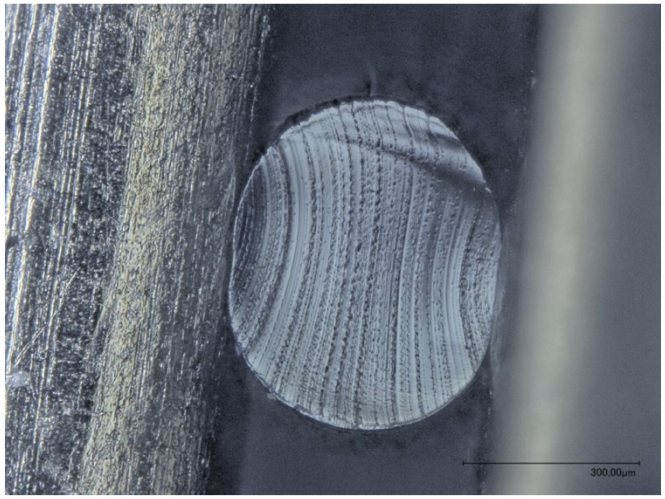
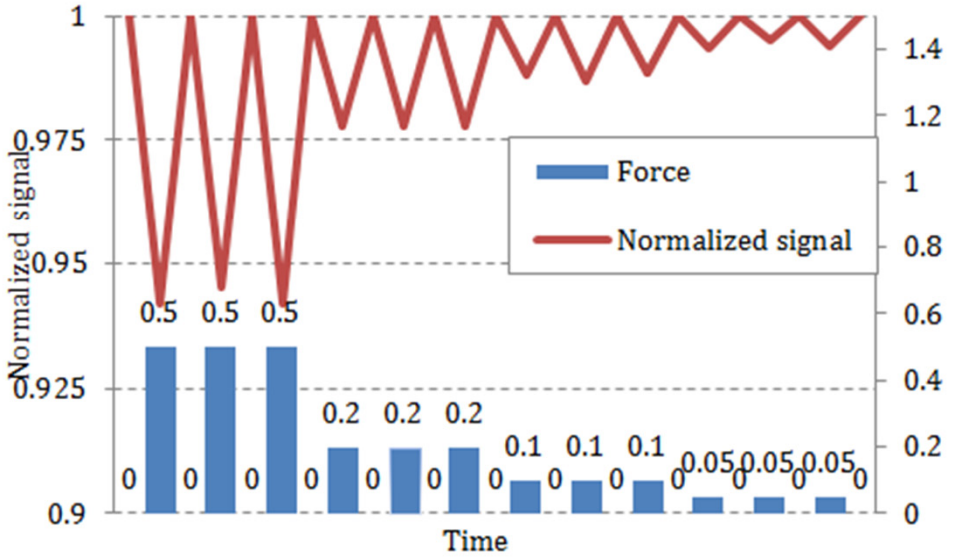
Drucksensor

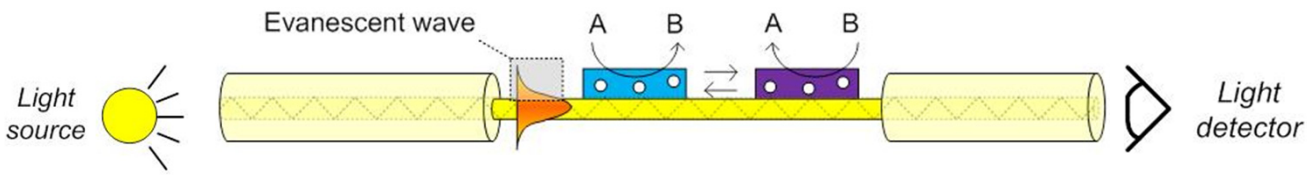


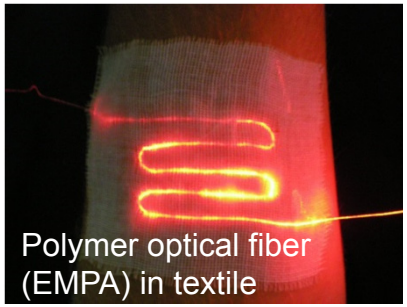


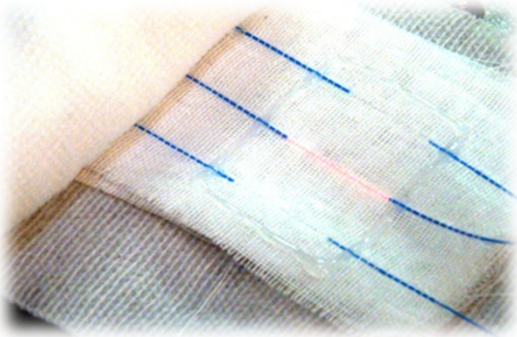


Überwachung von Wunden mit biosensitiven optischen Fasern

Detection principle



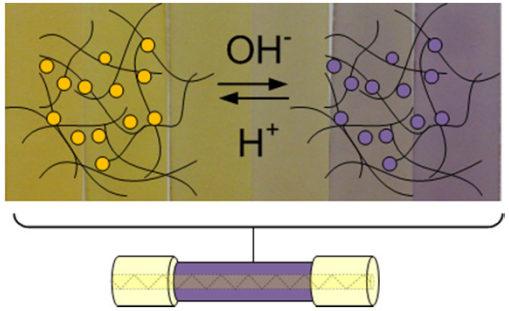




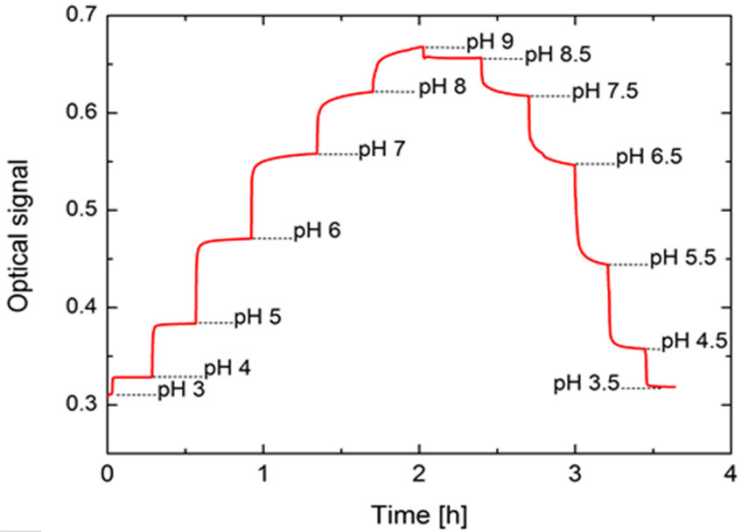
Sensing region

Biosensing optical fibers integrated in wound dressing

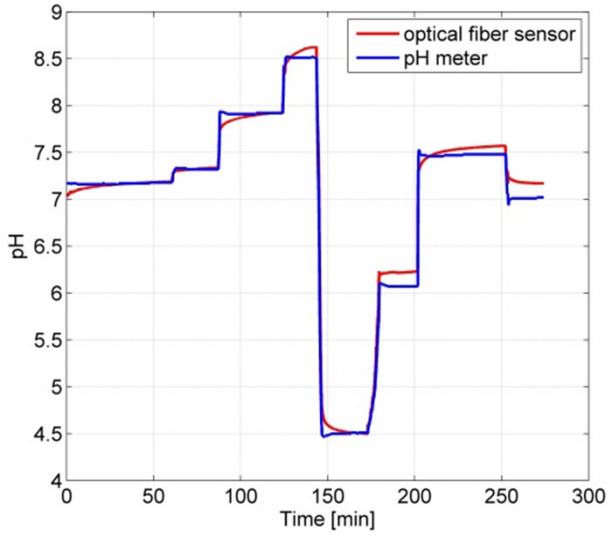
pH Messung mit optischen Fasern



Color variation of ORMOSIL film doped with pH indicator (Bromophenol blue)

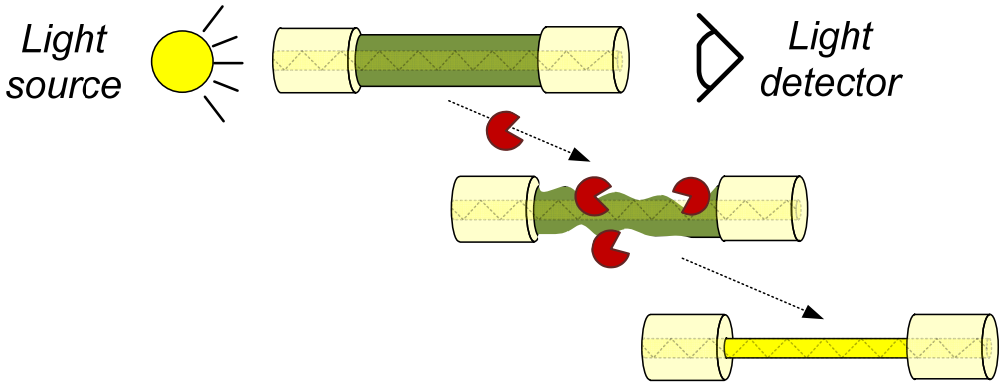


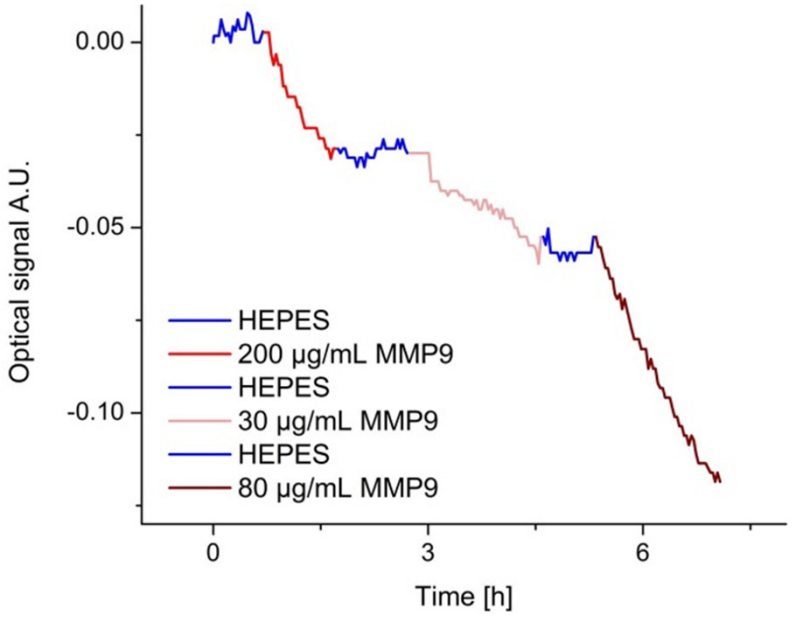
Sensor response to pH



Real-time pH measurement

Protease Messung





Degradierung des mit Chlorophyllin benetzten Gelatin-Film durch Protease

Echtzeiterkennung von MMP-9 Aktivität

Erkennung von MMP-9 und MMP -2 Protease erfolgreich an menschlichem Serum getestet

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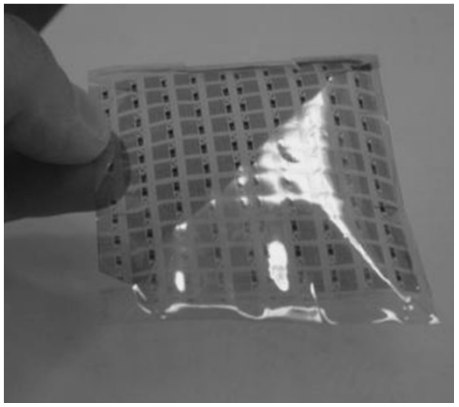
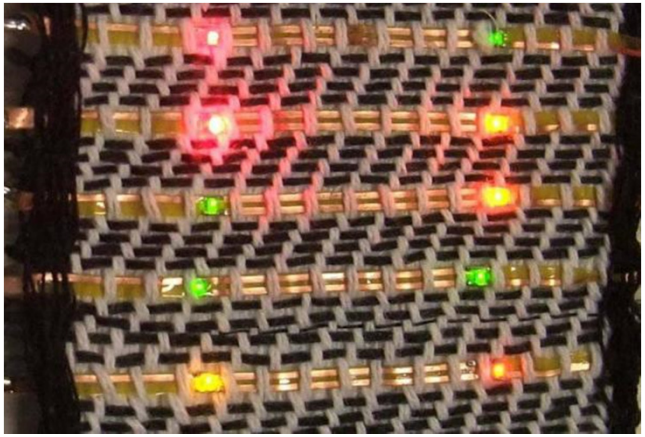
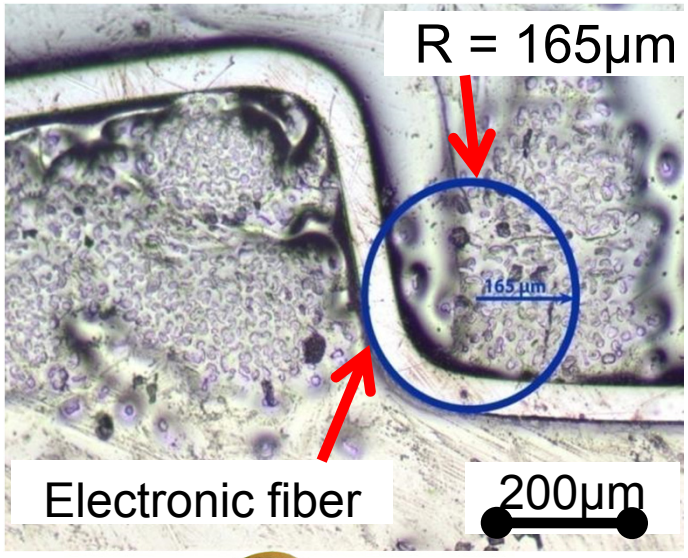
E-Streifen: Dünnfilm-Technologie in Textilien

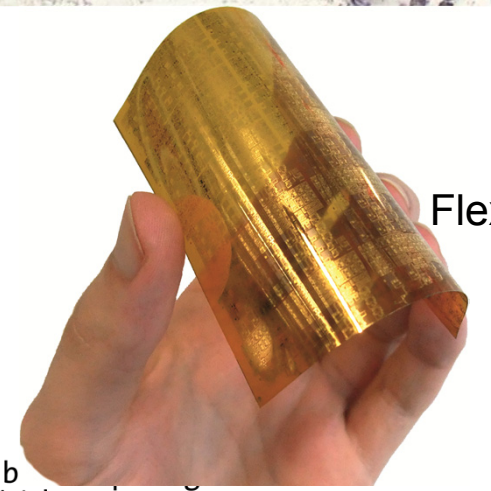
- planare Dünnfilm-Technologie
  - Sensoren
  - Transistoren
  - Integrierte Schaltungen ICs
- schmale (< 0.5mm) Streifen, in Textilien eingewoben





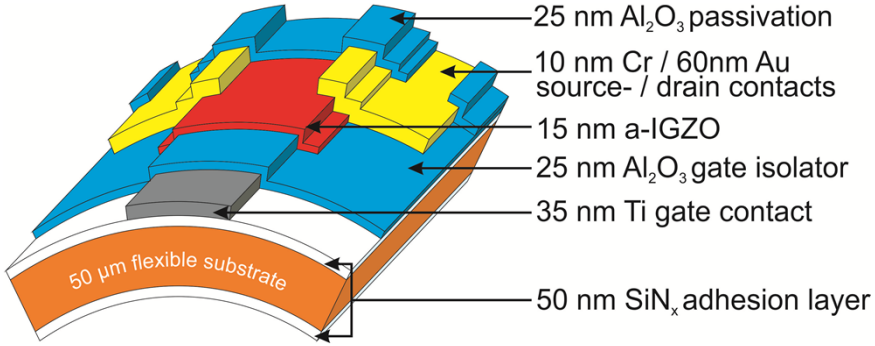
Biege-Eigenschaften

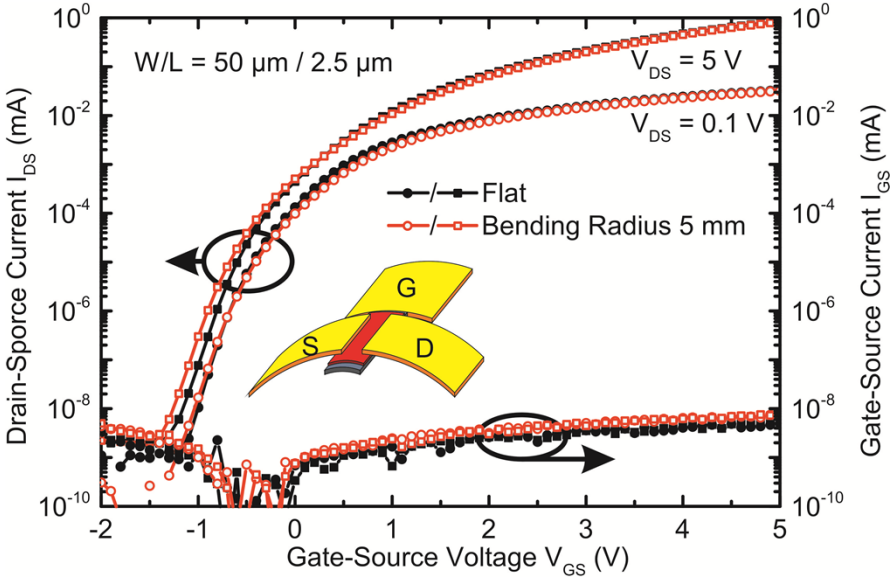




Flexible substrate

Flexible TFTs

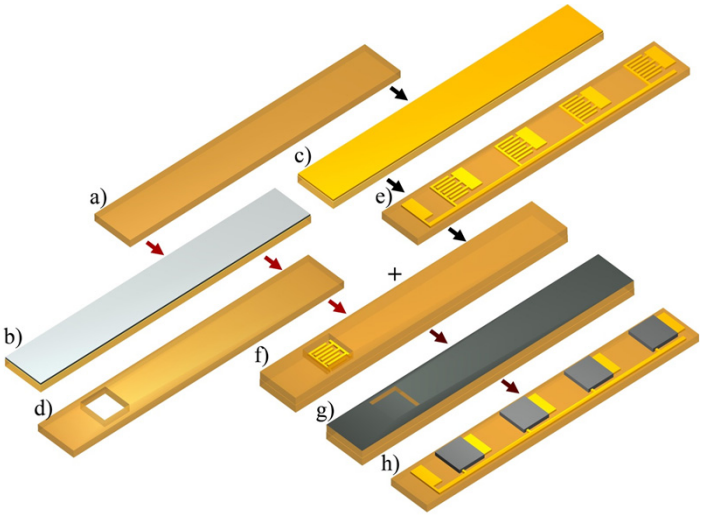


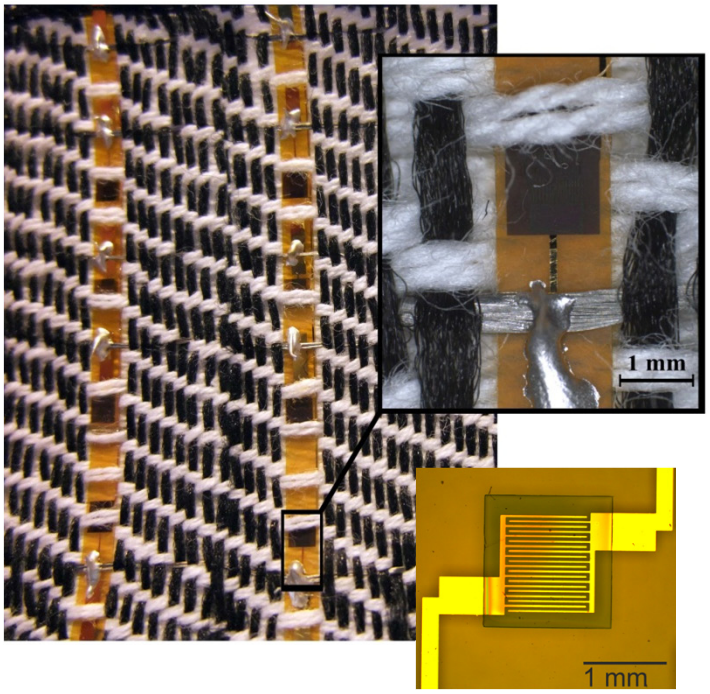


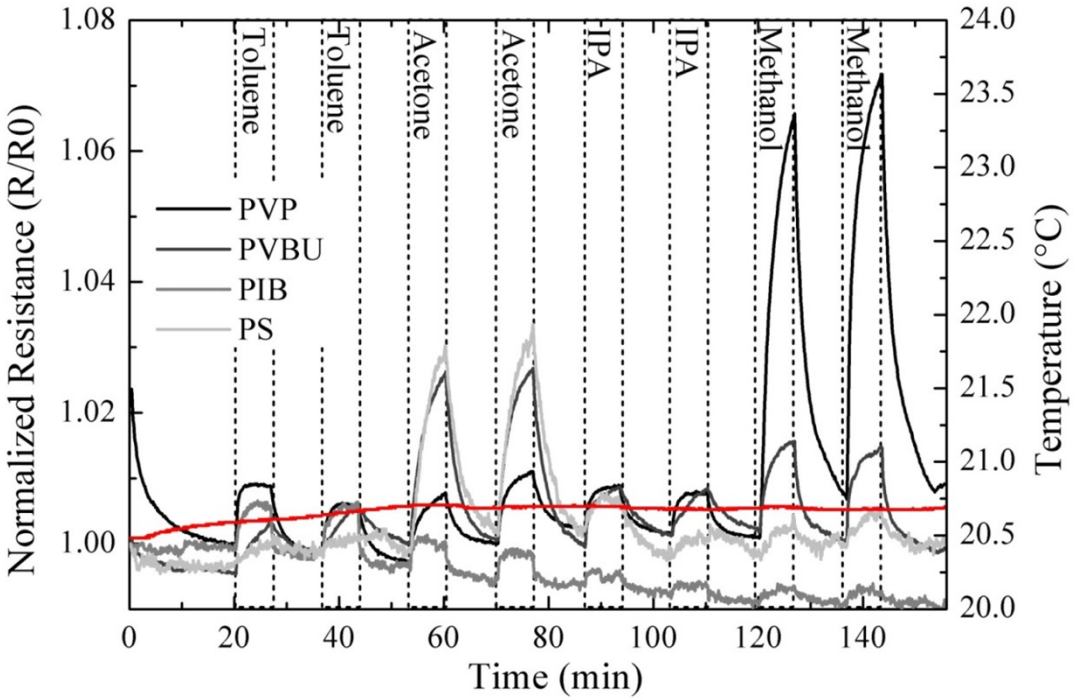
Transfer characteristic flat and bent (r =5 mm)

Flexible Gas Sensoren

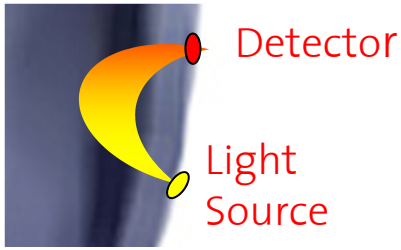
Methanol, IPA, Toluene, Azeton

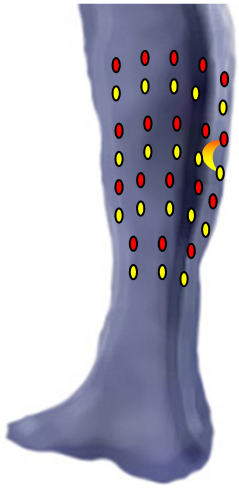






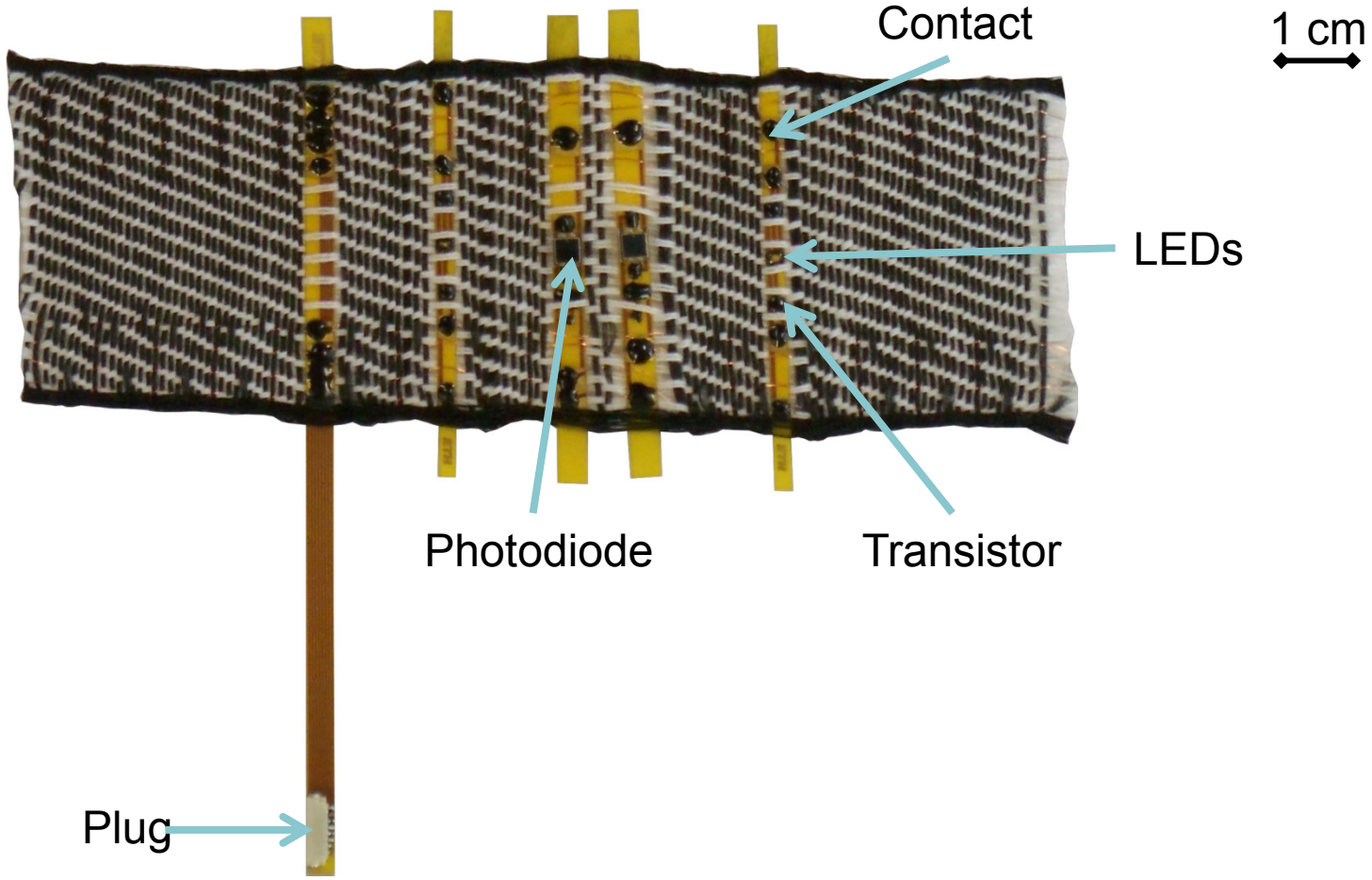
NIRS (Near Infrared Spectroscopy) im Strumpf



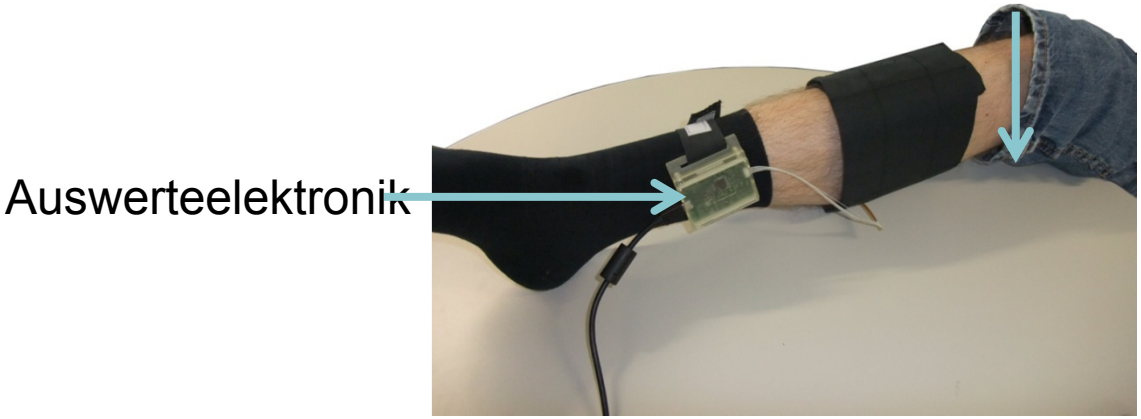


Früherkennung und Behandlung von
Durchblutungsstörungen (Peripheral Vascular Disease PVD)

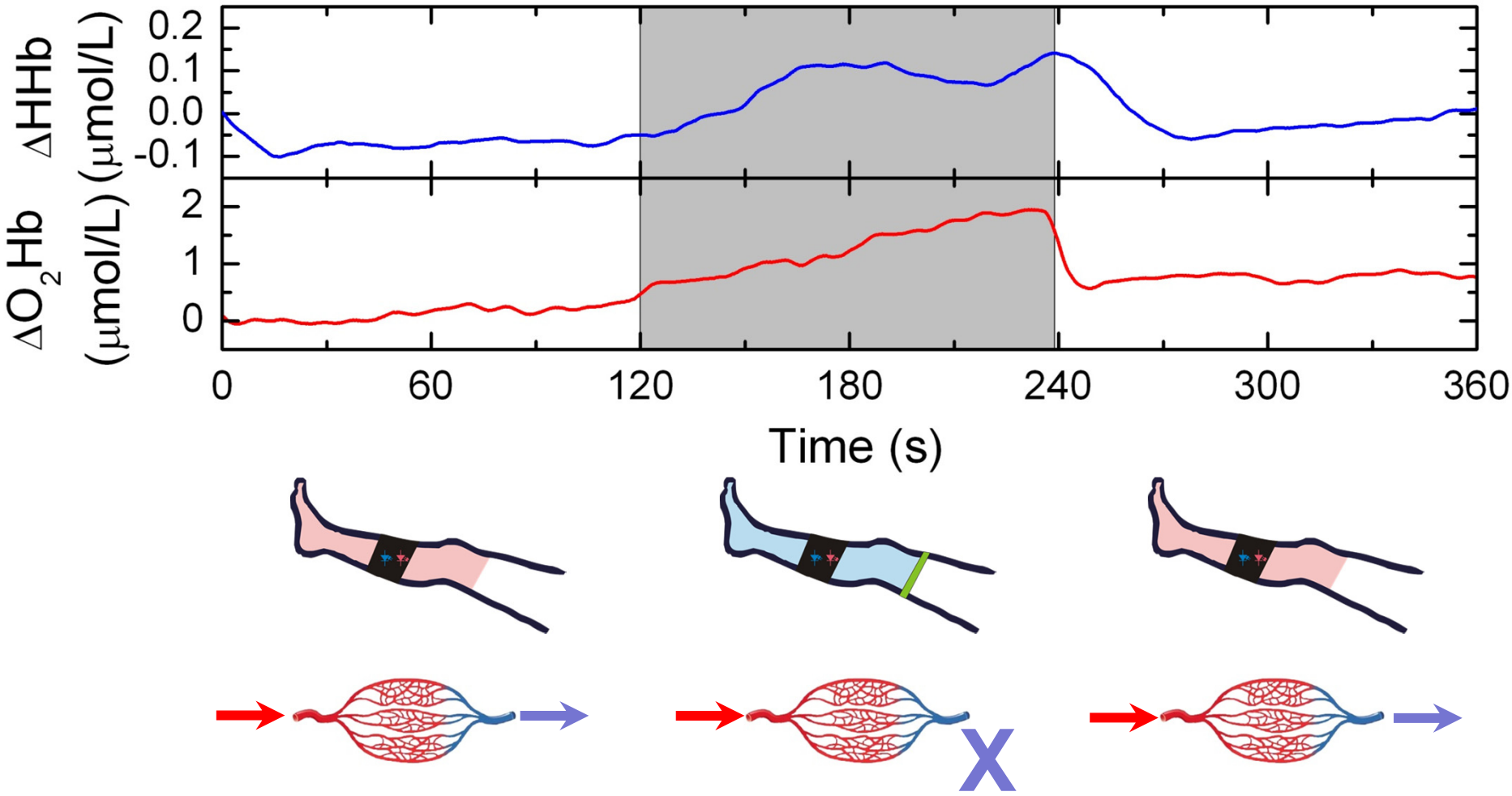
Textile NIRS



NIRS um die Wade gewickelt



Erkennung Venenverschluss



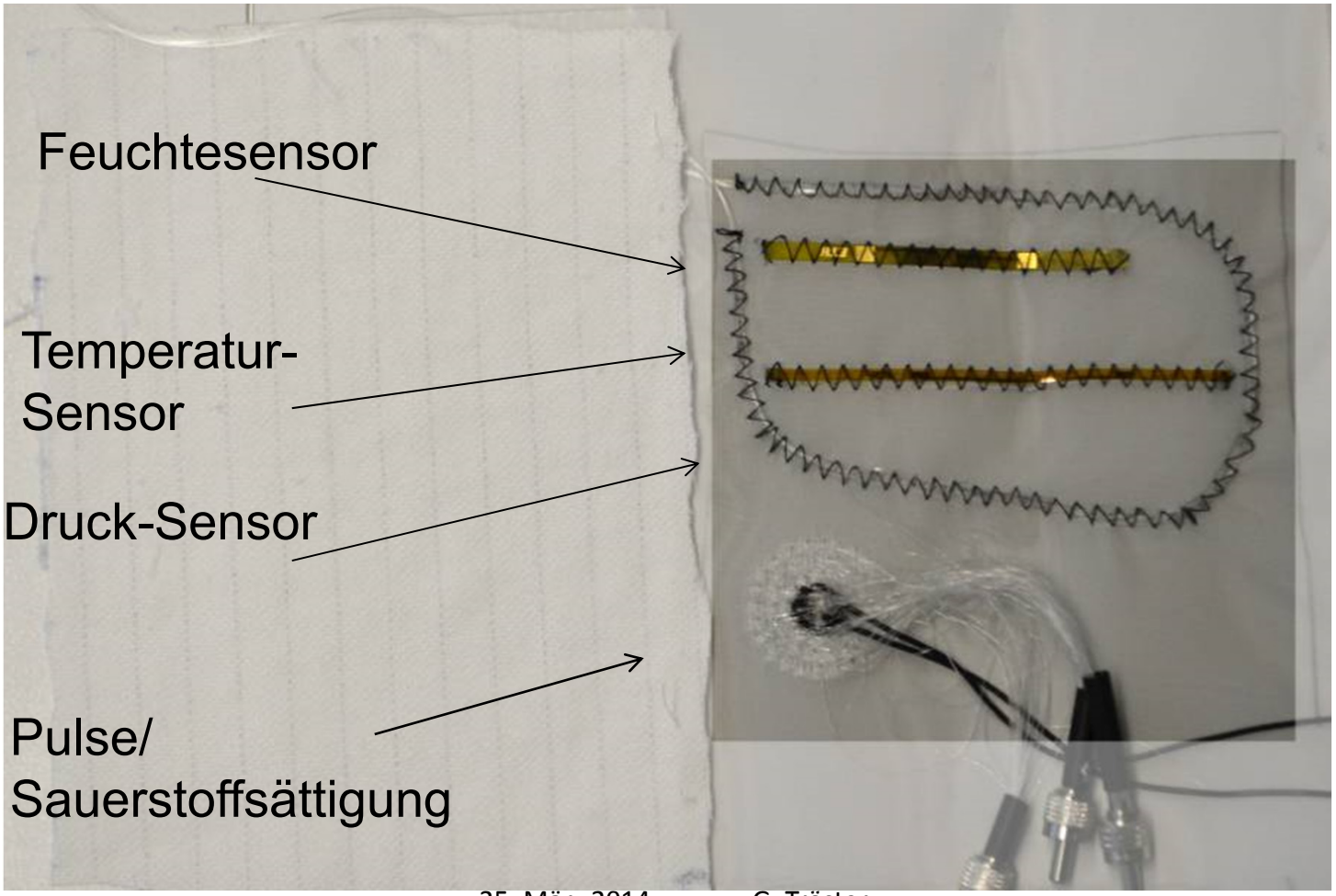
Textile Sensoreinlage für Querschnittsgelähmte

hohes Dekubitus Risiko

Überwachung

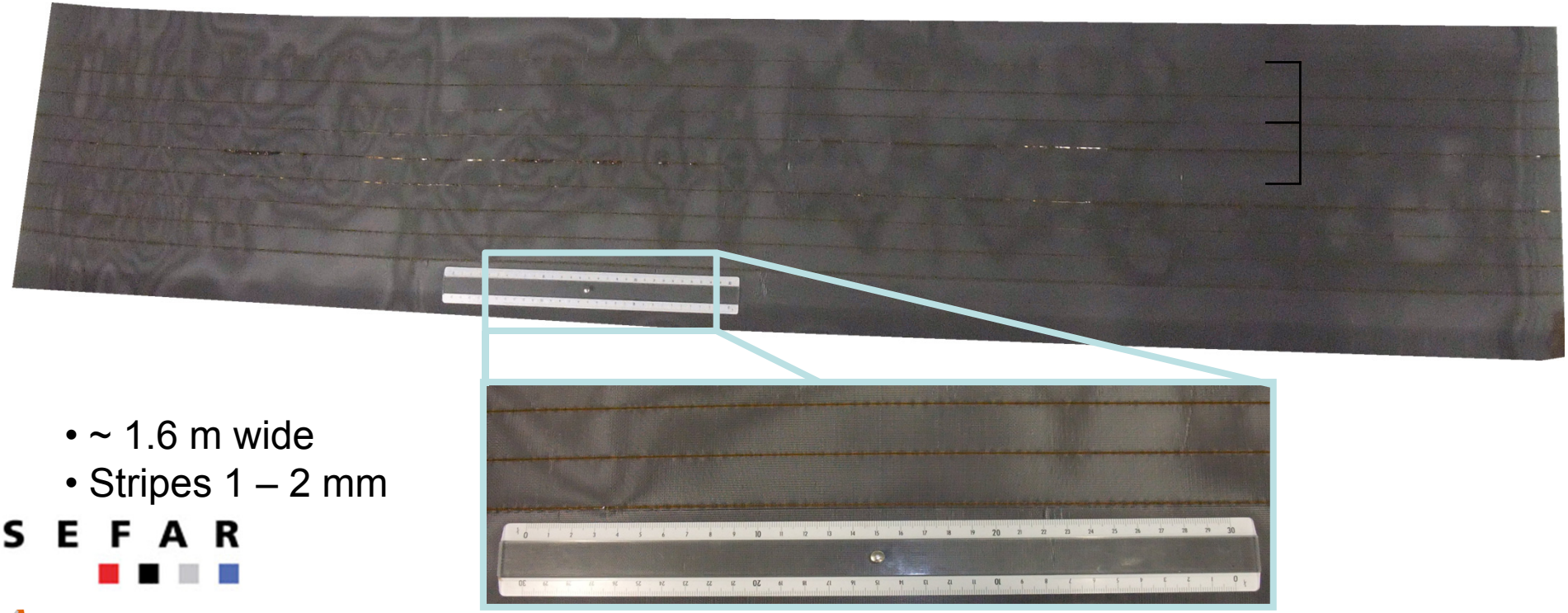
Druck, Feuchtigkeit, Temperatur, Sauerstoffsättigung

Textile Einlage mit integrierten Sensoren



Anwendung Rollstuhl

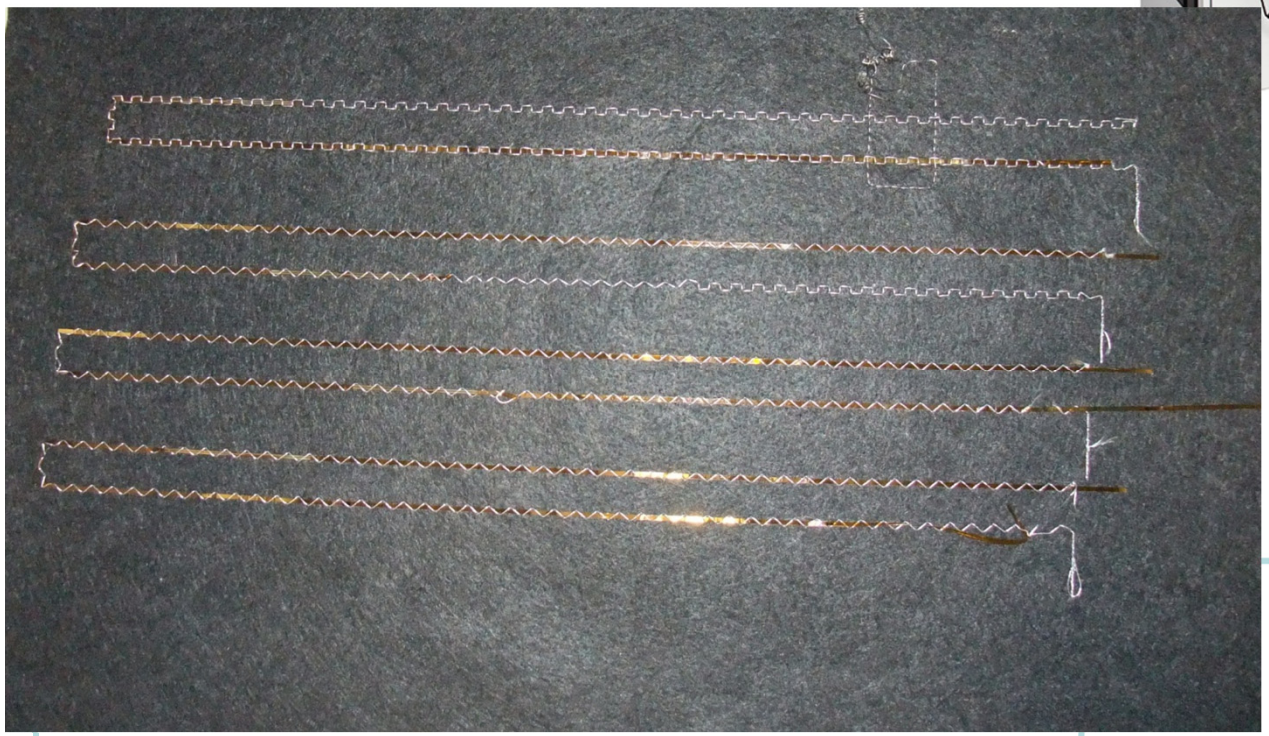
Transfer in die Industrie: Weben der E-Streifen



- ~ 1.6 m wide
- Stripes 1 – 2 mm

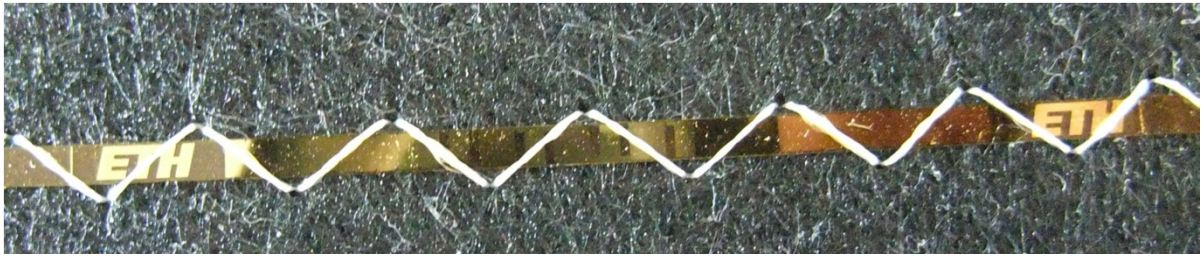
S E F A R

Transfer in die Industrie : Sticken der E-Streifen



18 cm

45 cm



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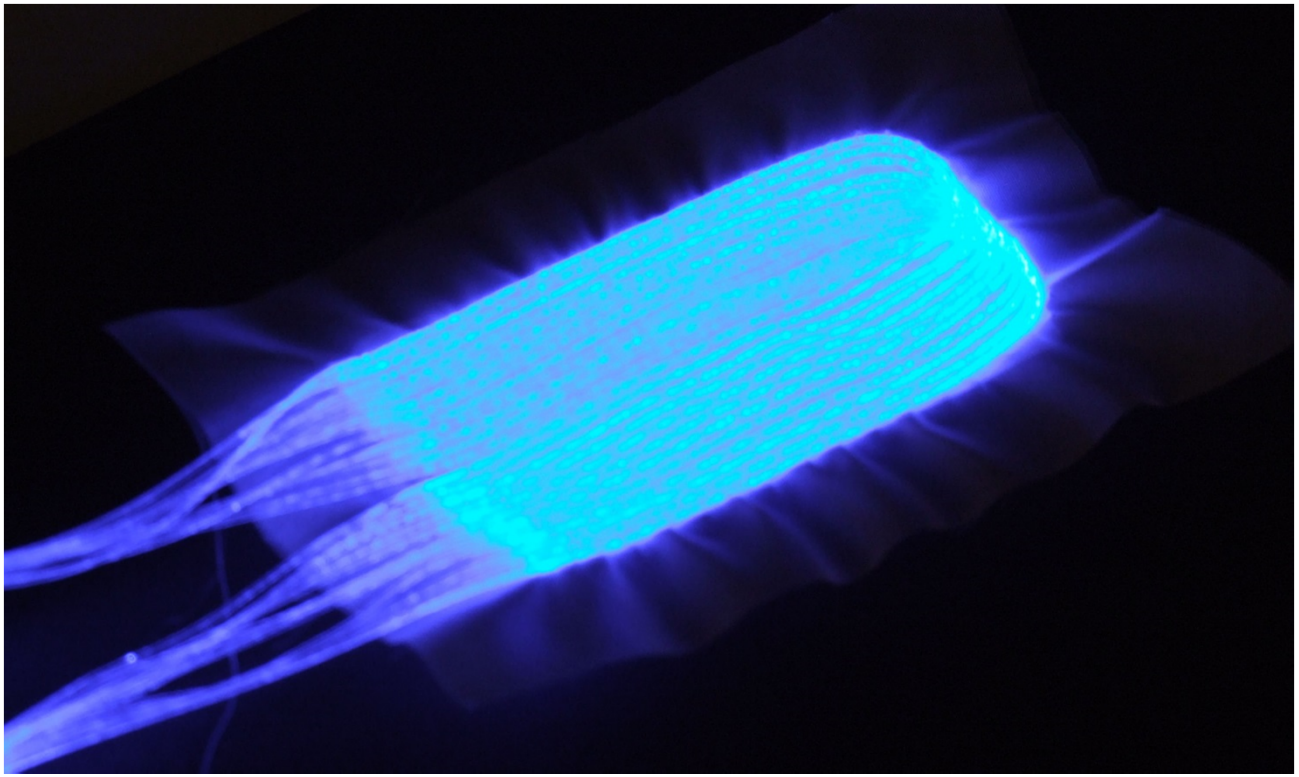
Gestickte optische Fasern



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