A2

Mechanically Soft Micro and Macrocomposite for Wearable Devices

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biomagnetic sensing SFB 1261

Motivation and Objectives

Challenge 1: Reduction of intrinsic electric and magnetic noise sources in ME sensors

Reduction of sensor components to elementary magnetic/electric fields

Magnetic field:
- Permanent magnets

Electric field:
- Permanent, self-polarized electrets
- Real charge electrets

Challenge 2: A2 sensor currently only available on lab scale

=> Sensors implemented into flexible, organic ME sensors for wearable application

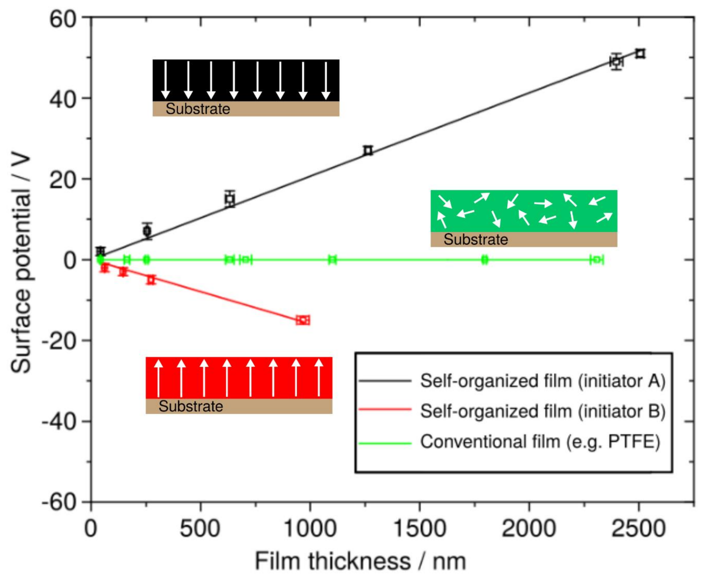
New approach: Combine previous materials and concepts to realize composite device with advantages of each component

Main objectives: Fundamentals, fabrication & characterization of flexible and integrated sensor systems

Transfer from lab individual devices to real medical application environment

Electrets and soft conductors

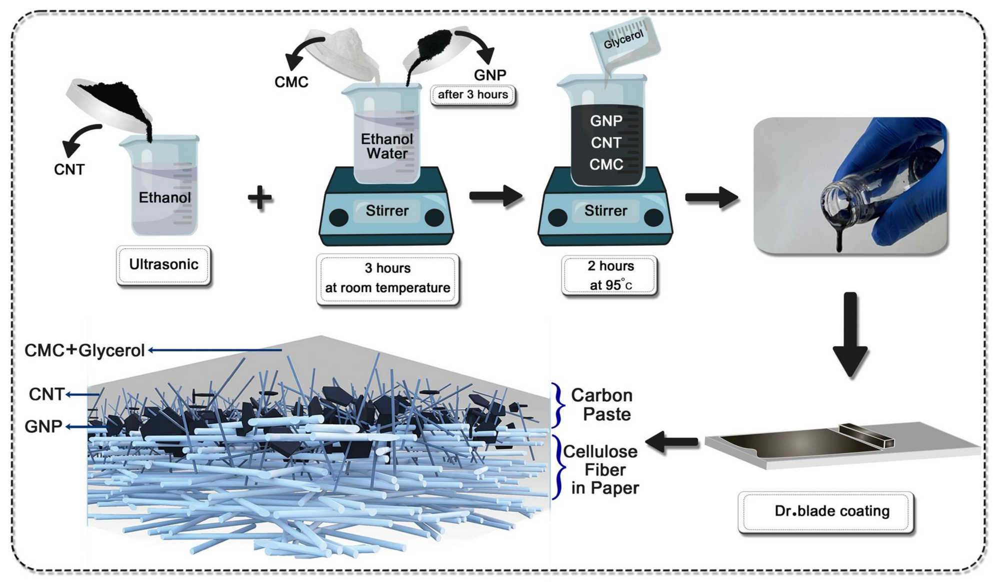
- Multilayer electrets via (iCVD) to reduce electret-based noise (e.g. burst noise)
- Self-polarized iCVD polymer films with permanent potential
- Soft conductors based on iCVD coated AeroPEDOT:PSS [A2-03]

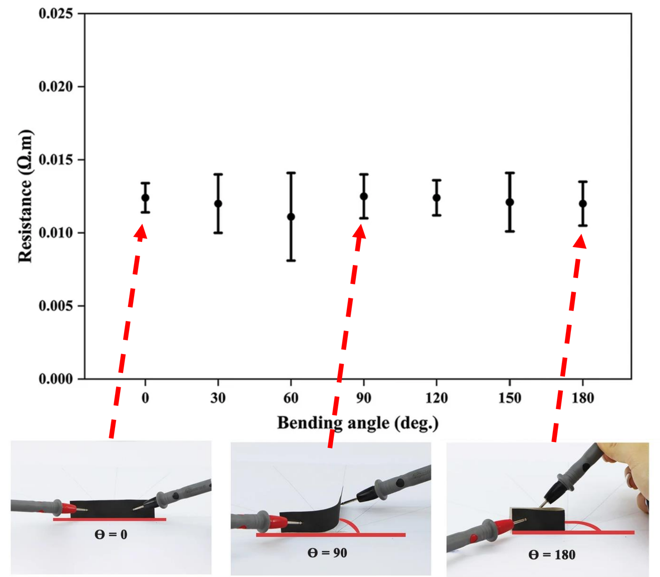


Example: Self-polarized polymer films – Charging/poling no longer necessary

Printed electronics

[A2-06, A2-07, A2-09, A2-10]

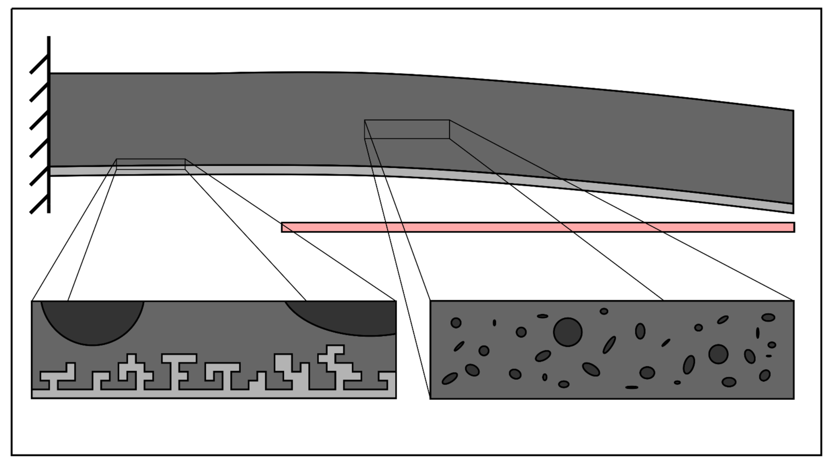


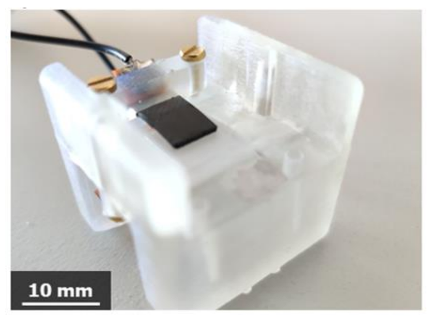


Example: Flexible carbon paste films [A2-08]

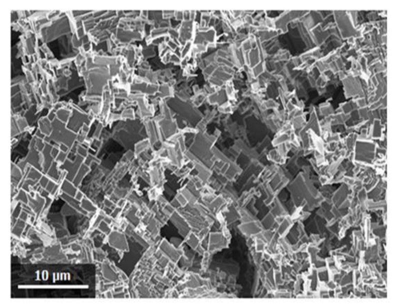
Results of the Second Funding Period

Sensor type 1: Microscopic sensor





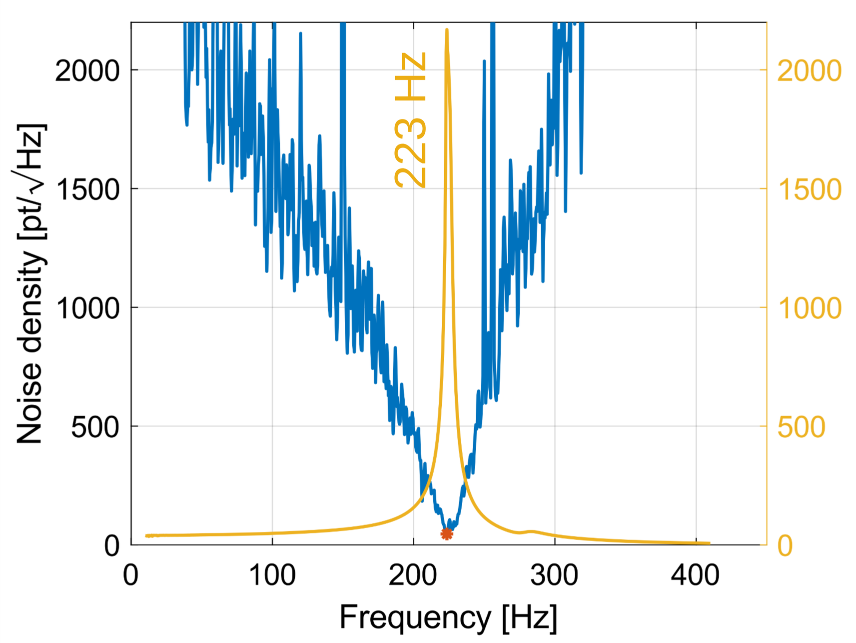
Customized sensor platform

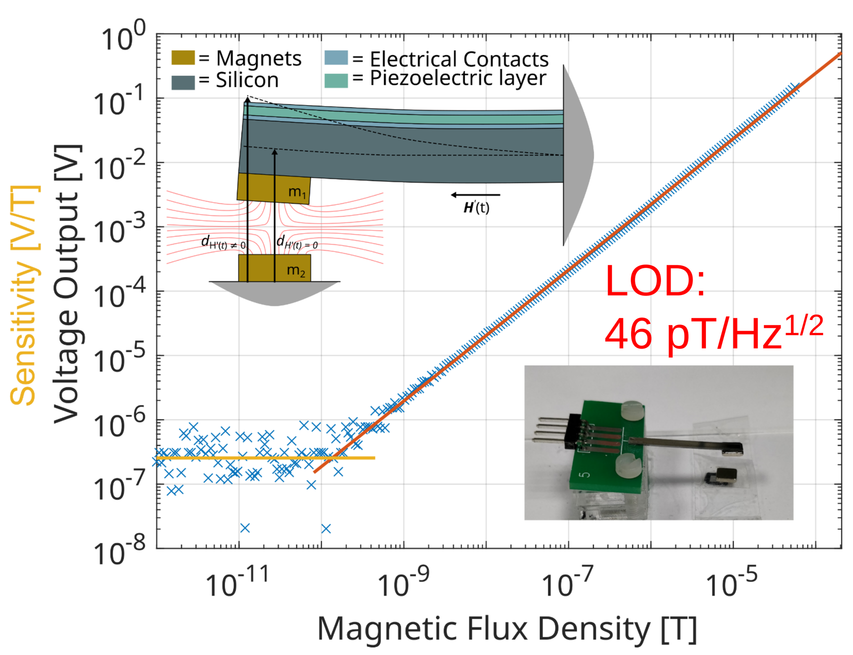


Structured Al interlocking agent

[A2-2, A2-4, A2-5]

Sensor type 2: Macrocomposite sensor [A2-1]





Work Plan for Third Funding Period

Research methods

Fabrication of ME sensor medical system: additive and substrative 3D manufacturing and iCVD

Encapsulation: EMI, iCVD

Characterization: FTIR, XPS, Kelvin-Probe AFM, TSD, Custom adoptable ME Setup

Modeling and sensor design: FEM (**A10**)

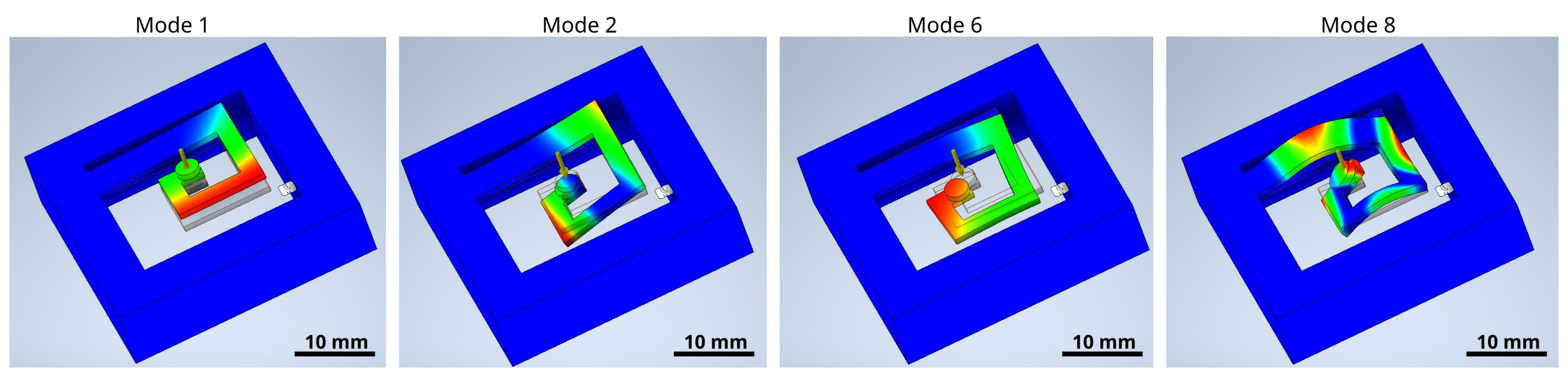
Work plan

WP1 Micro- and macrocomposite magnetic sensors

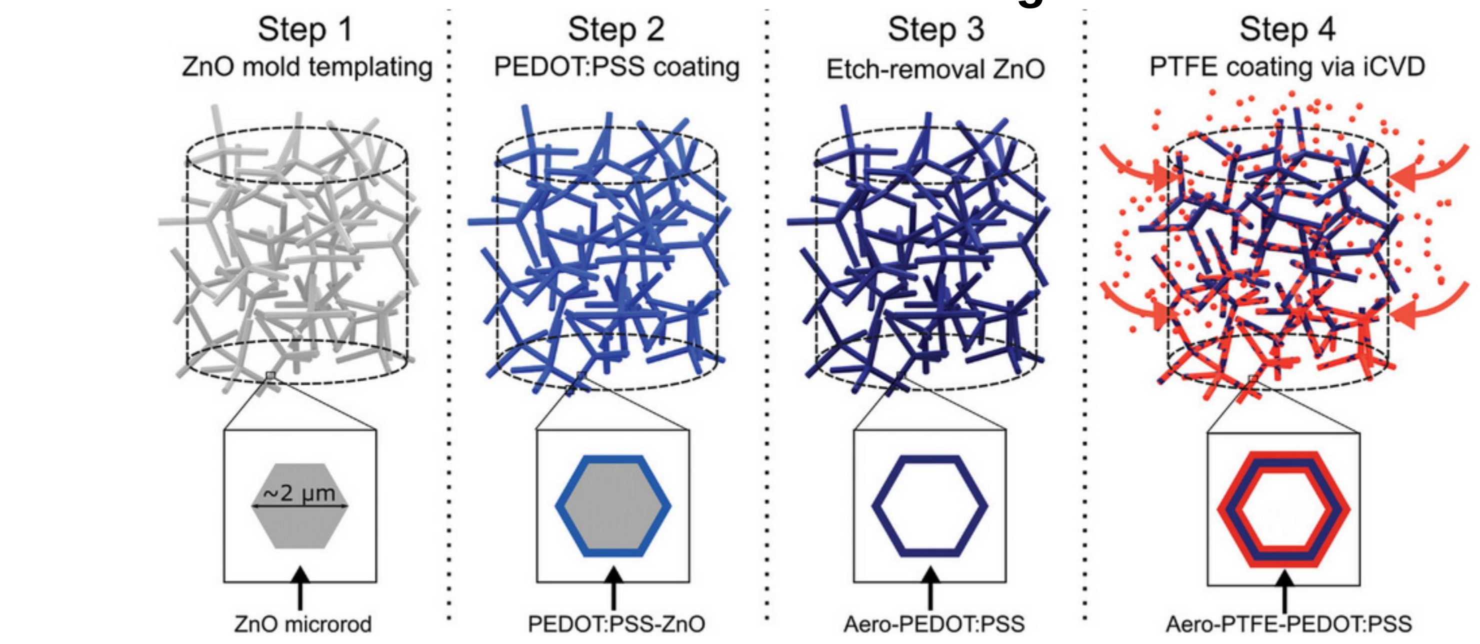
Macro: two permanent magnets

Micro: microparticles in polymer matrix

WP2 Spiral oscillator for multifrequency resonance

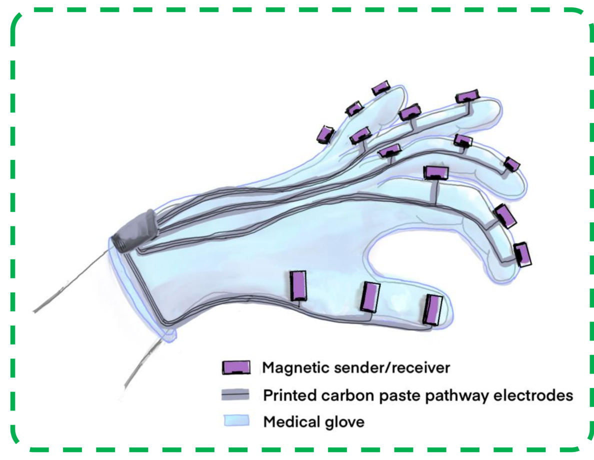


WP3 Soft electrodes and flexible conducting tracks

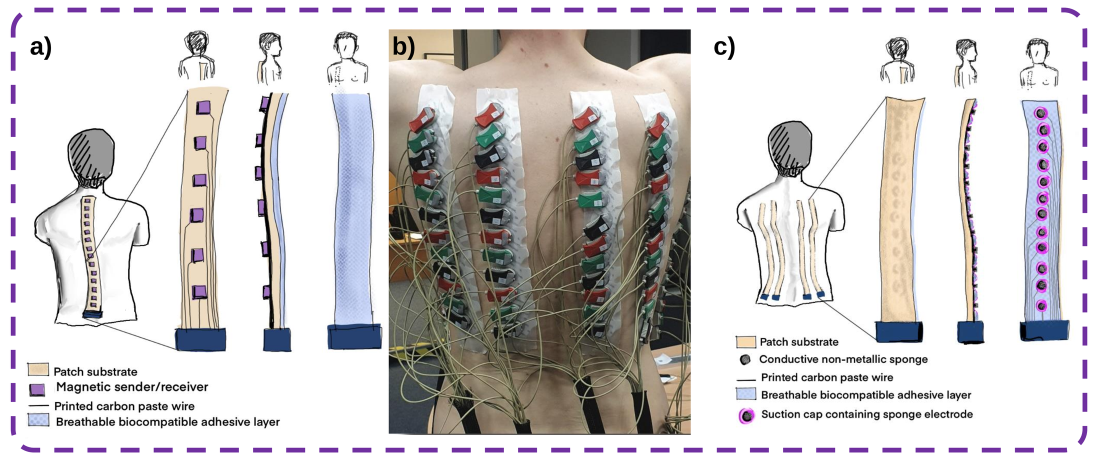


Example: PEDOT:PSS-PTFE strain-invariant soft electrodes

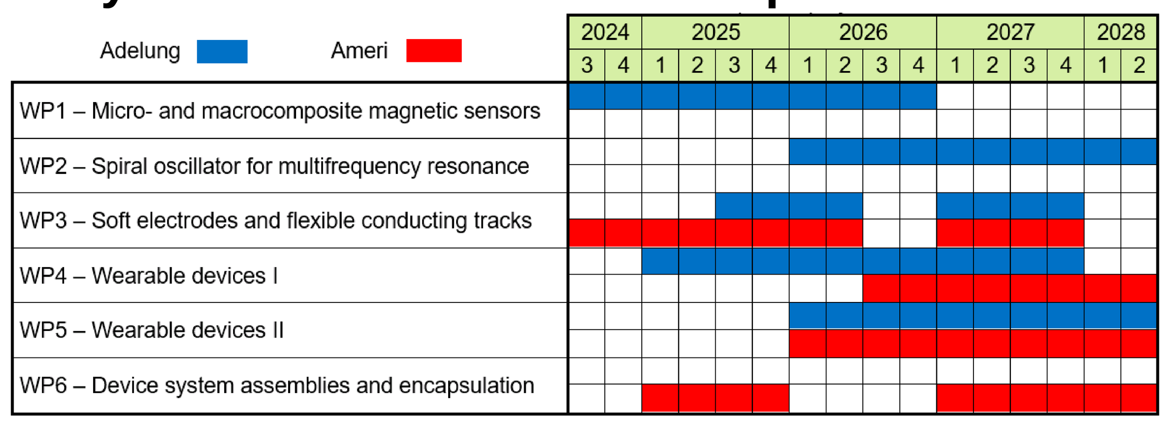
WP4 Wearable devices I



WP5 Wearable devices II



WP6 Device System assemblies and encapsulation



Collaborations

A6: Microstructural characterization

A10: Simulation of composites

B9: Support for the movement

B10: Exchange on implantable devices, develop on ECG patch

B11(N): Development of positioning system using a self-powered transmitter

Z1: Powder magnets, Z1 provides cantilevers used in WP1

Z2: Magnetic characterization

Participation in focus groups

F3: Comparison of Sensor concepts

F4: Magnetoelectric Sensors

Funds Requested

2 Doctoral researcher, consumables: 64 k€

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