

## PFI Project Description

# IDEAS<sup>2</sup>: Intelligent Dielectric Elastomers for Pressure Measurements in Footwear

*What pressures arise at the contact surface between shoe and foot during walking? Plantar pressure measurement has long been standard practice but hitherto no 360° pressure measuring system has been available for use in shoes. The project known under the acronym IDEAS<sup>2</sup> – „Intelligente dielektrische Elastomere als Sensoren im Schuhinnenraum“ (“Intelligent Dielectric Elastomers as Sensors in Shoe Interiors”) has the objective of developing a sensor system for dynamic pressure measurements in the entire shoe interior.*

### Status quo:

No upper sensor currently exists which can be used for investigating the mechanics of walking and which can supply all the relevant information. Interaction between upper and foot can so far only be assumed from persistent foot deformation. For example, only little is known about the consequences of constant pressure on the toe joints and the instep; yet the consequences are dramatic for diabetics.

### Aim of the project:

The project has goal of developing a sensor system which can be used to measure pressure during walking at the contact surface between the shoe and the foot everywhere in the shoe interior.

Such a system would allow a deeper understanding of the mechanics of walking and provide insights for orthopaedics and orthopaedic footwear technology, for diabetic care and rehabilitation as well as for textile and footwear engineering in general, because it would also provide a basis for the development of new products, processes, and services.

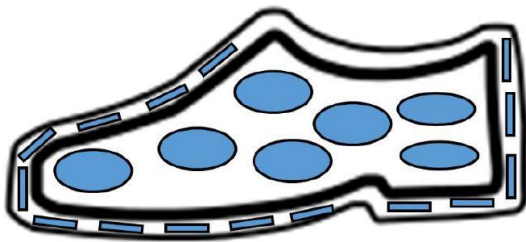
### Approach adopted:

Smart materials are the starting point. So-called dielectric polymers are plastics, which change shape when stimulated by an electric field and also exhibit the reverse effect, i.e. show capacitively induced voltages when the shape is changed. This dielectric effect is to be utilised in this project.

The project partners address the following points in order to try out the tested and possibly modified components in a working model:

- Dielectric elastomers
  - Capacitive sensors
  - Pressure and extension measurement (extension >100%)

- Adaptation of sensor geometry
  - Measuring point
  - Sensitivity setting (pressure or extension)
  - Shielding against external influences
- Characterisation
  - Signal interpretation
  - Service life
- Electronics
  - Digitisation of the sensor output
  - Wireless data transmission



**Project status:**

Ongoing project. Funded by IGF under the funding reference number 20421 N.  
Duration: 1 January 2019 to 31 December 2020

Partner: ZeMA gGmbH, Saarbrücken

**Please address inquiries to:**

Dipl.-Ing. Peter Schultheis  
Head of Technical Development and Footwear Engineering  
Tel.: +49-(0)6331-249040  
E-Mail: [peter.schultheis@pfi-germany.de](mailto:peter.schultheis@pfi-germany.de)