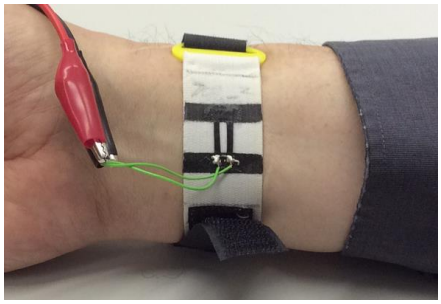
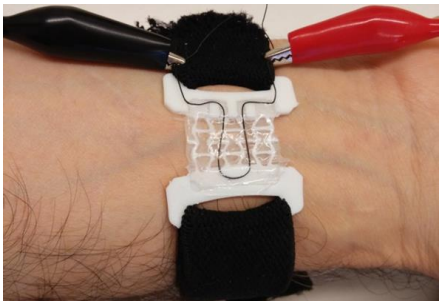
Soft Condensed Matter Hybrid Fiber Sensors based on carbon nano materials

M. Melnykowycz, T. Lusiola, F. Clemens
Empa Materials Science and Technology, Duebendorf, Switzerland
Frank.clemens@empa.ch

Abstract: The shape of soft bodies, such as in the case of human beings most likely changes when in motion. Even more, the human body remains a dynamic object even when not in obvious motion due to muscle and tendon reflexes, breathing, heartbeats, cardiovascular system and other factors. In the last years, Empa, Laboratory for High Performance Ceramics, has developed soft condensed matter sensor (SCMS) based on carbon nano materials to be able to monitor soft bodies. Studies using the new type of piezoresistive SCMS, body motion of humans and soft robotics as well as vital functions can be measured with such kind of sensors by integration them into textiles, elastomer based structures [1-3]. Studies by changing the carbon material and the carbon content show a significant change in the sensor performance. This behaviour will be further investigate in the near future.

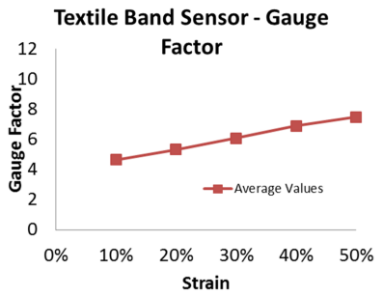


A) Textile band sensor worn on a wrist.

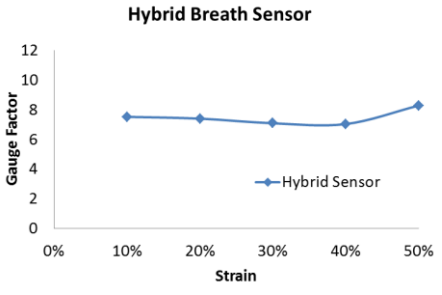


B) Elastomer band sensor worn on a wrist.

Figure 1: Mounted piezoresistive SCMS integrated in textile and elastomer structures.



A) Tensile gauge factor of the textile structure



B) Tensile gauge factor of the hybrid elastomer

Figure 2: Sensor data of the two different systems.

References

[1] C. Mattmann, F. Clemens, G. Tröster. Sensor for Measuring Strain in Textile. Sensors 8 (2008), 3719–3732.
[2] U. Culha, S.G. Nurzaman, F. Clemens, F. Iida. SVAS3: Strain vector aided sensorization of soft structures, Sensors 14 (2014), 12748-12770.
[3] M. Melnykowycz, M. Tschudin, F. Clemens. Piezoresistive Soft Condensed Matter Sensor for Body-Mounted Vital Function Applications. Sensors 16 (2016), 326.