Modelling of application related effects for flexible capacitive strain sensors

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The wide range of applications of strain sensors leads to an increased interest on flexible, cost effective and low power devices for strain and bending measurements [1-2]. A simply structured sensor that meets these requirements is studied using finite element analysis (FEA). The device is depicted in Fig.1 and is essentially composed of 5 thin flexible layers: three layers of pure Polydimethylsiloxane (PDMS) separated by two conducting PDMS layers that can be made by dispersing nanoparticles e.g. carbon black, in the PDMS matrix (CB/PDMS). The operation principle of the sensor is based on the capacitance change between the two flexible conductive plates. The sensor modelling focuses on the sensor performance variations for different applications and takes into account the fabrication process that can be used for elastomeric sensors. The FE simulations were used in order to study factors that influence the strain sensor response in different possible applications. For this purpose, two models have been developed. The first one considers elongations of the sensor and two different boundary conditions were applied reflecting different sensor mountings. The second model places the sensor on the surface of a cantilever beam that is deflected vertically combining small strain with bending. Differences in the sensor response are observed depending on the mounting conditions and the model studied.

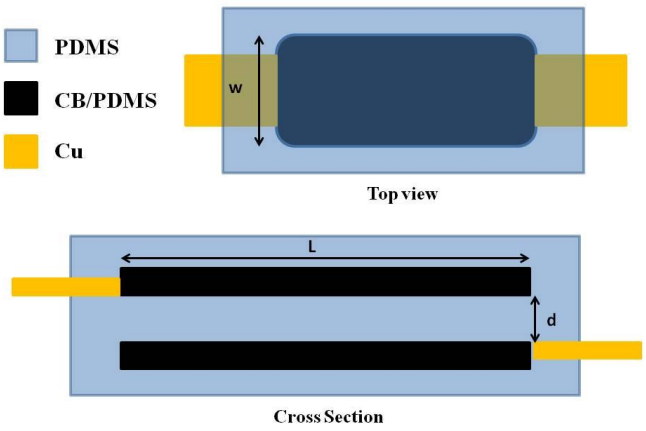

Figure 1: Schematic representation of the strain sensor.

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References

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[2] S-H Bae, Y. Lee, B. K. Sharma, H-J Lee, J-H Kim, J-H Ahn, Carbon, **51**, 236 (2013)

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