Compliant and breathable magnetoelectronics: towards electronic proprioception

eSensus

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Augmented reality gadgets, e.g. Microsoft HoloLens or Oculus Rift devices are becoming common for our information intensive society assisting us to acquire and process the data. Although impressive in the realization and demonstrations, the obvious drawback of state-of-the-art augmented reality gadgets, which typically rely on optical detection systems, is their bulkiness, heaviness and the stringent requirement for an operator to be at the line of sight of the device.

We envision that prospective augmented reality systems will rely on compliant on-skin interactive electronics, which is yet to be developed. In this project, we will develop haptically imperceptible on-skin gadgets, which replicate our natural proprioceptive sensory ability of detecting the motion.

These novel magnetosensitive smart skins should be realized in a way not to disturb our everyday activities while worn on skin. This statement necessarily means that the prospective shapeable magnetoelectronics should become not only mechanically compliant but also breathable, e.g. enabling water evaporation and transport of oxygen. In this respect, polymeric foils, which are typically used in the field of compliant electronics, should be replaced with ultrathin textile-like materials. Those, in turn, should support the realization of high-performance magnetic field sensors. We propose that fibrous materials are the most suitable substrates to achieve this goal and realize breathable and highly compliant magnetic field sensors.

Therefore, as the key objective of this project, we will explore the possibility to realize high-performance magnetic field sensors on fibrous materials. Furthermore, there is no data on the realization of breathable compliant permanent magnets, which are needed for on-skin applications involving compliant magnetic field sensors. Hence, ultimately, we aim at the development of the entire system containing breathable compliant magnetic field sensors, which will work in conjunction with breathable compliant magnets. In particular,

1/ We aim to fundamentally understand the correlation between chemical nature of polymers, structure of electrospun mats and their mechanical properties;

2/ We explore the possibility to realize high-performance magnetic field sensors on electrospun mats possessing porous structure with high local curvatures at the location of individual fibers;

3/ We aim on the fabrication of compliant and breathable permanent magnets and will address the interplay of the mechanical properties (stability, cyclic performance) of laminated magnetic composites and their magnetic performance (not only strength but also spatial symmetry of the magnetic stray fields).