2D Carbon-Based Skin-Electrodes for Sensing of Biosignals

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Monitoring human electrophysiological signals by application of electrodes onto skin provides access to a wealth of signals, such as brain, heart and muscle activities. For this, a reliable electrical contact between skin and electrode is required. Current state-of-the-art electrodes are mostly composed of metals and metal films that require a conductive gel to establish good epidermal contact [1]. This limits their application time due to drying out of the gel and the possibility of skin irritation caused by the gel itself or by metal allergies.

To address this problem, research is actively seeking biocompatible, lightweight and flexible materials that are stable for downsizing commercially available electrodes and enabling mobile and long-term measurements of vital functions. Promising candidates are ultra-thin, non-permanent tattoo-like epidermal electrodes based on carbonic 2D nanomaterials. Here, we present the fabrication [2], characterization and application of a variety of 2D carbon-based skin-electrodes. In preliminary studies, our electrodes, either based on ML-graphene [3] or graphene oxide, show promising long-term stability of several hours for continuously monitoring vital functions and excellent reproducibility of signals. Our findings indicate that these new types of miniaturized electrodes possess the potential for imperceptible, mobile, long-term sensing of vital functions through conformal skin contact while providing high sensitivity, reduced motion artefacts and low power consumption. Due to their ease of application, such electrodes could not only be applied in the medical field, e.g. for long-term ECGs (electrocardiograms), or EEGs (electroencephalograms) or as an interface with prosthetics or robotics but also in consumer-health technologies.

References

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Figures

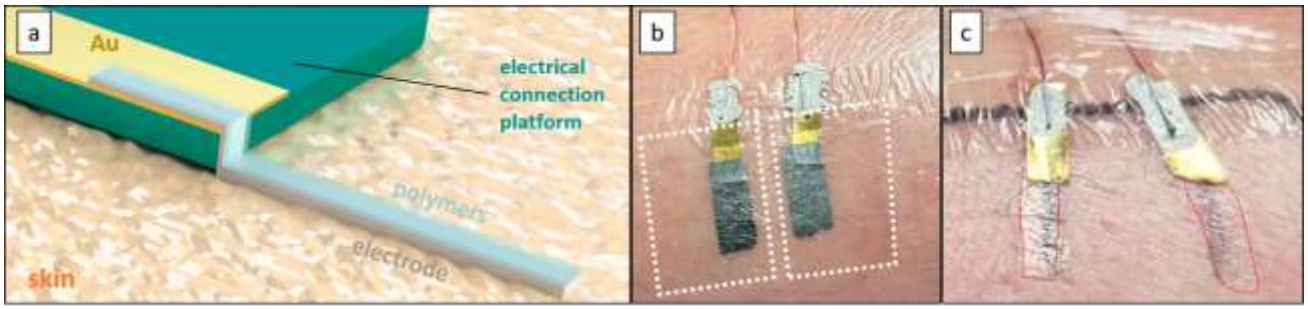

Figure 1: a) cross-sectional view schematic of carbon-based electrode on skin **b)** photo of graphene oxide-based electrode on skin with rectangles indicating the protective top poymer encaspsulation **c)** graphene monolayer electrodes indicated by red lines; black marker only for positioning.