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PATENT

Graphene transistor system for measuring electrophysiological signals

Market sector: medical device, graphene, neurology

Type of opportunity: licensing and/ or co-development

Scope of the problem

Brain–computer interfaces and neural prostheses based on the detection of electrocorticography signals are rapidly growing fields of research. Several technologies are currently competing to be the first to reach the market; however, none of them fulfill yet all the requirements of the ideal interface with neurons. Thanks to its biocompatibility, low dimensionality, mechanical flexibility, and electronic properties, graphene is one of the most promising material candidates for neural interfacing.
In this context, solution-gated field effect transistors (SGFETs) with the use of graphene as the conductive channel (gSGFETs) hold tremendous promise in biomedical applications due to the excellent properties in biocompatibility inherent in graphene, as well as extremely high mobility. Considering that gSGFETs combine flexibility, even stretchability if built in a proper design, biocompatibility, and excellent neural recording performance, it is believed that gSGFETs represent a very powerful technology that can help to advance the current knowledge and technology boundaries of in vivo neural electrophysiology.

Patient need addressed: monitoring brain signals (neural disorders)

Our innovation:

- New graphene solution-gated field-effect transistor arrays (gSGFETs) which are able to record infraslow signals alongside with signals in the typical local field potential bandwidth
- This device increases baseline stability that arises from the electrochemical inertness of graphene
- Transistors can be scaled up from micro to macro scale as needed while different kinds of electrical contacts
- The gSGFETs are preferably placed on epicortical and intracortical positions
- The gSGFETs are fabricated using flexible substrate to overcome the difficulty in conforming to the geometry of different biological structures
- Graphene-transistor arrays allows several applications and deployments which range from subdural, epidural and intracortical devices to other placements in the brain, peripheral and cranial nerves, heart, blood vessels, spinal cord and other biological structures or non-invasive placement similar to an electroencephalogram

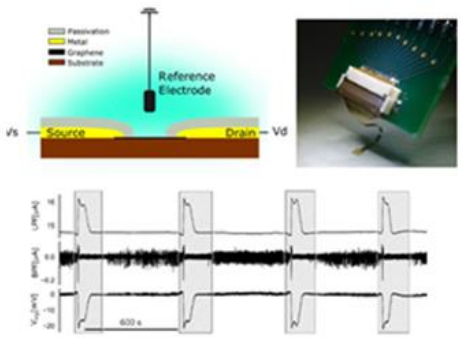

Fig.1) Flexible transistors system for neural applications.

Competitive advantages: Flexible and versatile graphene-transistor array, it provides amplification of signals and high-fidelity recording in a wide-bandwidth. The device can be applied to other biological systems such as heart, kidneys, stomach, cranial nerves, and other regions.

Market size/ opportunity: The global graphene market is expected to reach USD 278.47 Million by 2020, with a growth rate of 42.8% from 2015 to 2020 (Markets and Markets, 2018). An important segment will be graphene being explored as potential building block for nanoelectronics and medical devices.
In 2022, the global health care equipment & supplies market is forecast to have a value of €435.7 billion (18.6% for Other equipment segment). Geographical segmentation: USA 38.3%, Europe 31.7%, Asia-Pacific 24.2%, Middle East 0.8%, Rest of the World 5.1% (Marketline 0199-2067, November 2017).

Intellectual property

Priority European patent application filed
Suitable for international extension (PCT application)

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