Graphene technologies for neural prostheses

Jose A. Garrido

Catalan Institute of Nanoscience and Nanotechnology (ICN2), Barcelona, Spain

The Barcelona Institute of Science and Technology, Barcelona, Spain

ICREA, Barcelona, Spain

joseantonio.garrido@icn2.cat

Establishing a reliable bidirectional communication interface between the nervous system and electronic devices is crucial for exploiting the full potential of neural prostheses. Despite recent advancements, current technologies evidence important shortcomings, e.g. low signal-to-noise ratio for signal mapping, low charge injection capacity for nerve stimulation, poor long-term stability, challenging high density integration, etc.

Thus, efforts to explore novel materials are essential for the development of next-generation neural prostheses. Graphene and graphene-based materials possess a rather exclusive set of physicochemical properties holding great potential for biomedical applications, in particular neural prostheses [1].

This presentation will provide an overview on fundamentals and applications of several graphene-based technologies and devices aiming at developing an efficient bidirectional communication with electrogenic cells and nerve tissue. In this respect, the presentation will review recent technology developments exploring the capability of graphene-based devices for recording and stimulating electrical activity in both in vitro and in vivo experiments [2].

The main goal of this talk is to discuss the potential of graphene technologies in the field of neural interfaces and prostheses, and at the same time to identify the main challenges ahead.

Figures

Figure 1: Artistic representation of a graphene-based flexible electrocorticography (ECoG) device for mapping cortical activity.

References

[1] Kostarelos et al., Advanced Materials 2017

[2] Hebert et al., Advanced Functional Materials 2017

Acknowledgements

This presentation is based on a large collaborative effort conducted in the frame of the European projects Graphene Flagship and BrainCom.