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Graphene-Assisted Lipid Bilayer: A Synthetic Cell Model

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Introduction: Bio-compatibilized G/GO/RGO composite structures with embedded stearic acid on a bilayer structure model, biomimicking the cellular lipid bilayer are introduced through successive models.

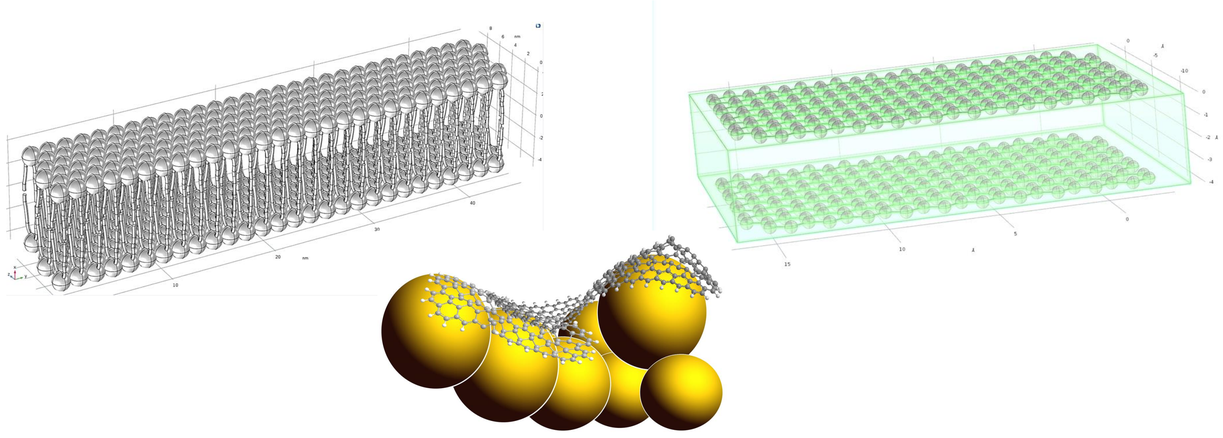


Figure 1. Graphene vs. Lipid Bilayer

Computational Methods: The solvent accessible surface of the models (van der Waals surface) and the related MD values were imported from Molecular Dynamics through MATLAB® studies, using LiveLink™ for MATLAB®.
Within the modeling, simulation and validation of the graphene-assisted-lipid bilayer were used as well: COMSOL Multiphysics®, CFD, Semiconductor and Particle Tracing modules.

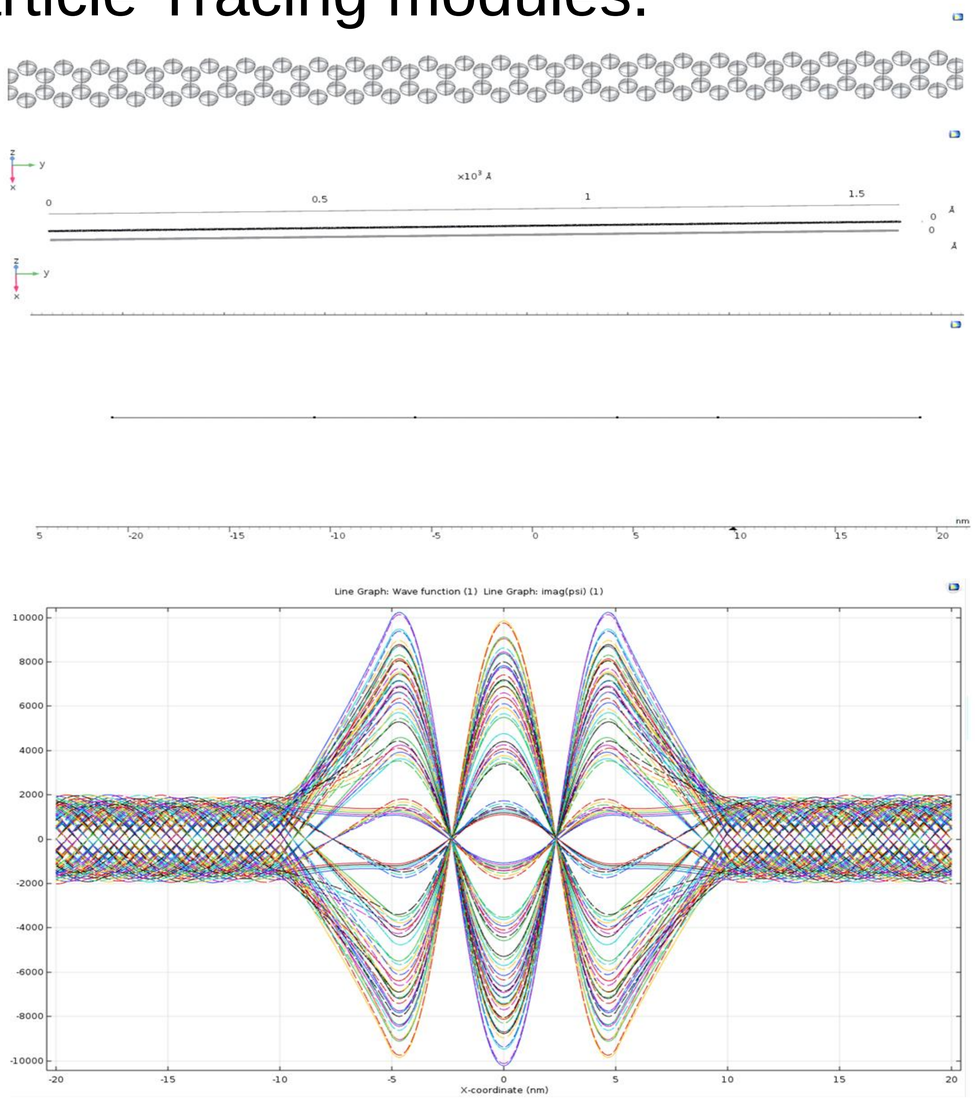
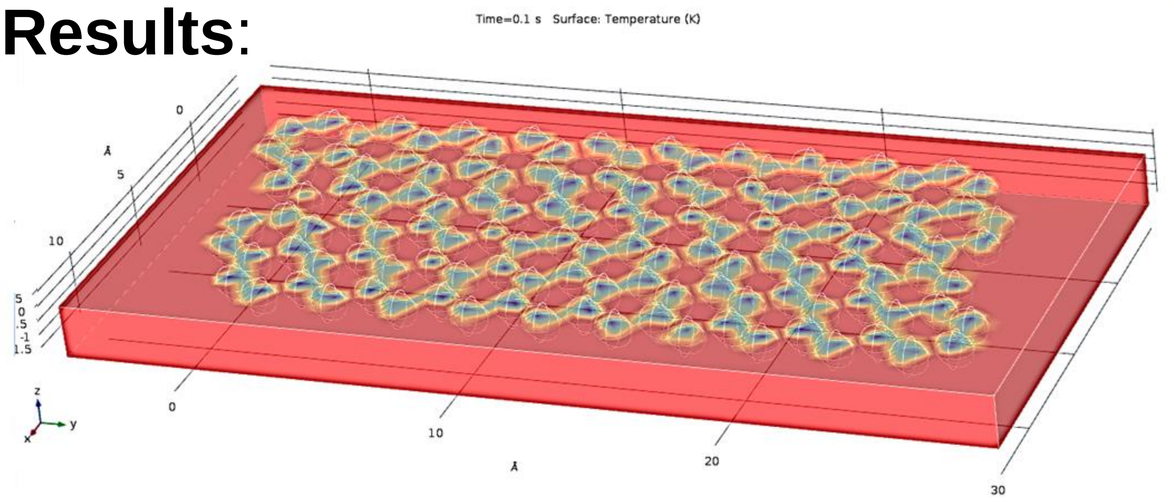


Figure 2. Graphene Ribbon -1D model of Cell Membrane (successive models at real size)

Results:



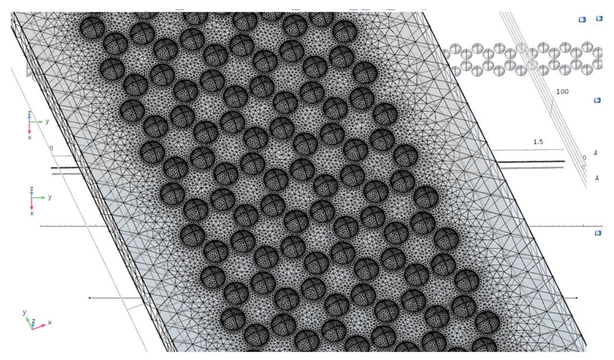


Figure 3. COMSOL® model of Graphene composite – Functional cell membrane

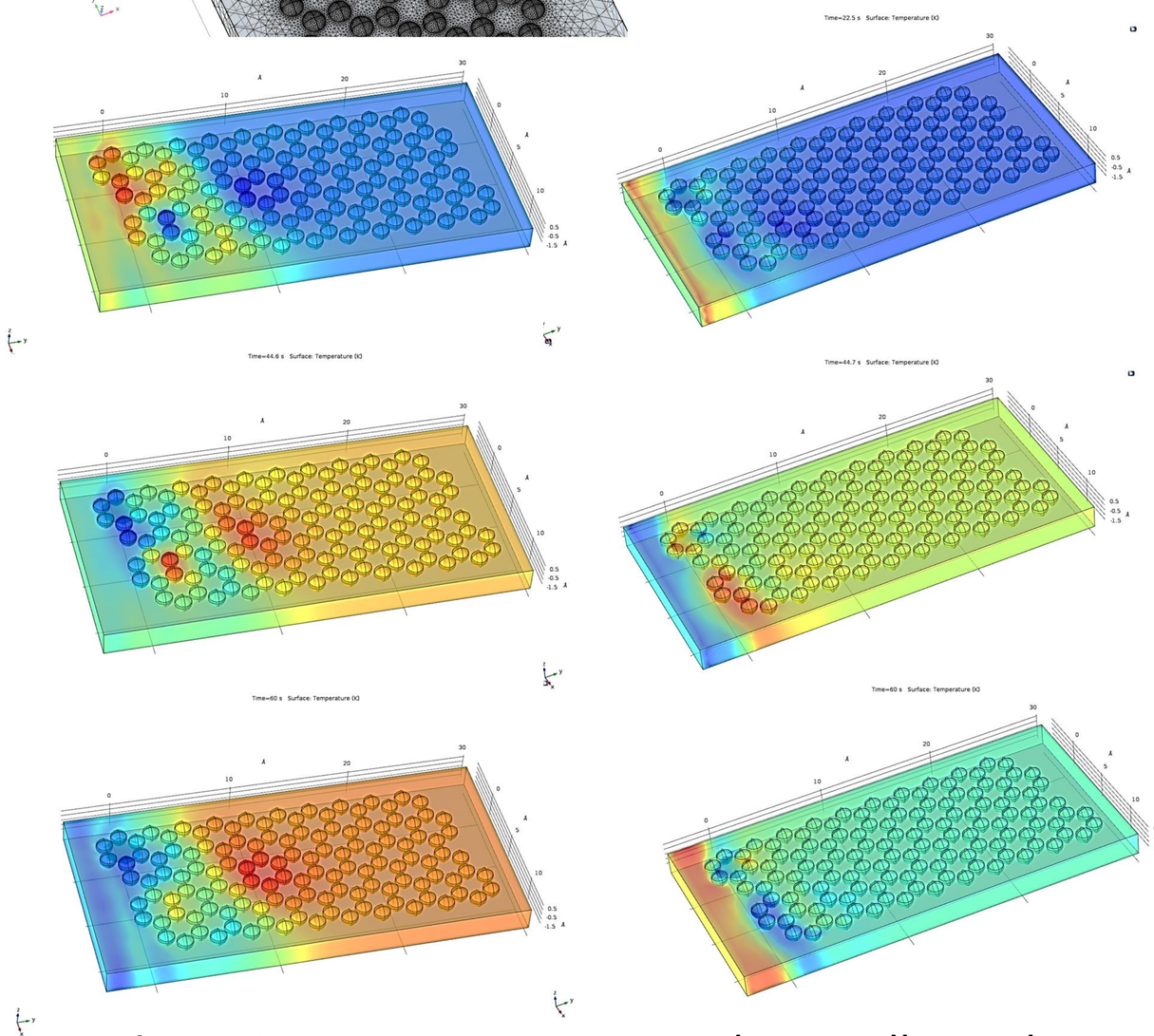


Figure 4. Temperature on synthetic cell membrane
a,b,c – Graphene – solid
d, e, f - Graphene - surface

Conclusions: Beyond a biomimetic synthetic interface for personalized bio-info-applications this model brings a real size-shape relationship between the organic and inorganic nanostructures at this scale, with the size related Physics (Quantum and Bio-Quantum) proper consideration.

References:

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2. E. Lacatus , Charge carrier transfer in functionalized biomimetic sensing nanostructures, DOI:10.1016/j.bbabio.2016.04.265, BBA - Bioenergetics Volume1857, (2016)
3. E. Lacatus , Modeling a multilayered graphene biosensing structure, Materials Today, DOI:10.1016/j.matpr.2016.06.007 , (2016)