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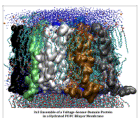
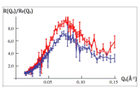
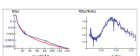
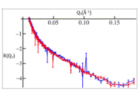
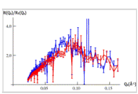
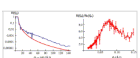
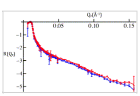
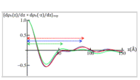
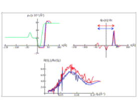
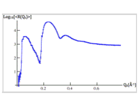
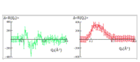
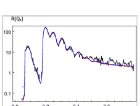
Abstract
Keywords
1. Introduction
2. Experimental methods
3. Results and discussion
4. Conclusions
Acknowledgments
Appendix A. Supplementary data
References

Figures and tables

Supplementary data 1

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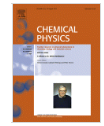
A tribute to Dr. Robin Hochstasser



Structural changes in single membranes in response to an applied transmembrane electric potential revealed by time-resolved neutron/X-ray interferometry

A. Tronin[a], C.-H. Chen[a], S. Gupta[a], D. Worcester[b, c], V. Lauter[d], J. Strzalka[e], I. Kuzmenko[e], J.K. Blasie[a,]
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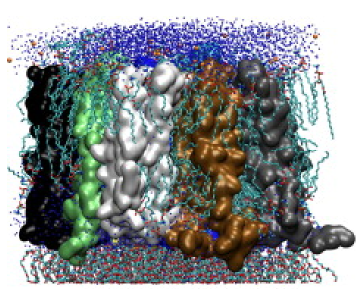
Abstract

The profile structure of a hybrid lipid bilayer, tethered to the surface of an inorganic substrate and fully hydrated with a bulk aqueous medium in an electrochemical cell, was investigated as a function of the applied transbilayer electric potential via time-resolved neutron reflectivity, enhanced by interferometry. Significant, and fully reversible structural changes were observed in the distal half (with respect to the substrate surface) of the hybrid bilayer comprised of a zwitterionic phospholipid in response to a +100 mV potential with respect to 0 mV. These arise presumably due to reorientation of the electric dipole present in the polar headgroup of the phospholipid and its resulting effect on the thickness of the phospholipid's hydrocarbon chain layer within the hybrid bilayer's profile structure. The profile structure of the voltage-sensor domain from a voltage-gated ion channel protein within a phospholipid bilayer membrane, tethered to the surface of an inorganic substrate and fully hydrated with a bulk aqueous medium in an electrochemical cell, was also investigated as a function of the applied transmembrane electric potential via time-resolved X-ray reflectivity, enhanced by interferometry. Significant, fully-reversible, and different structural changes in the protein were detected in response to ±100 mV potentials with respect to 0 mV. The approach employed is that typical of transient spectroscopy, shown here to be applicable to both neutron and X-ray reflectivity of thin films.

Graphical abstract



3x3 Ensemble of a Voltage-Sensor-Domain Protein in a Hydrated POPC Bilayer Membrane