Experimental report

07/04/2019

Proposal: 9-13-776 **Council:** 4/2018

Title: Floating Lipid Bilayer supported by PEG Brushes

Research area: Soft condensed matter

This proposal is a new proposal

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Samples: H2O
D2O
NaCl
POPS
POPC
DPPC
DPPS
DSPE-PEG (2k)

Instrument	Requested days	Allocated days	From	To
D17	3	2	15/09/2018	17/09/2018
FIGARO	3	0		

Abstract:

For decades, floating lipid bilayers supported by soft polymer brushes or cushions have been considered ideal platforms for structural and functional studies of lipid bilayers and biological membranes. But despite great efforts,most of the conceived sample architectures did not meet the expectations, because the polymer brushes typically collapse due to strong favourable interactions between the lipids and commonly used solid supports.
Here, we propose the structural investigation by neutron reflectometry of brush-supported floating bilayers in the form of a triple-monolayer architecture realized by using a Langmuir/Schaefer - Langmuir/Blodgett - Langmuir/Schafer transfer procedure. With this architecture we have already obtained promising preliminary results.

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Floating Lipid Bilayer supported by PEG Brushes

The aim of the proposal was to test the possibility of forming floating lipid bilayers onto solid substrate decorated with PEG brushes. For this purpose, silicon substrate coated with OTS have been used to deposit a first lipid monolayer by Langmuir Schaefer deposition. Three different charged monolayers have been studied:

1. DPSC/18:0 TAP (70/30 mol/mol ratio)
2. DPSC/18:0 TAP/DSPE PEG 2k (60/30/10 mol/mol/mol ratio)
3. DPSC/18:0 TAP/DSPE PEG 5k (65/30/5 mol/mol/mol ratio)

The samples have been chosen to keep constant the charge density of the surface, provided by the 18:0 TAP lipid.
Subsequently, POPC/POPS (70/30 mol/mol ratio) bilayers have been deposited by Langmuir Blodgett and Langmuir Schaefer depositions. Samples have been studied at different contrast (D_2O, H_2O, *SiMW)* and at different NaCl content (0 mM, 5 mM, 20 mM, 100 mM).

Results

The first target of the proposal was to show that it is possible to deposit fluid state lipid bilayers (POPC/POPS) onto polymer brushes (PEG) of different "length", as the PEG 2k and 5k.
In Figure 1 we show reflectivity data obtained by floating POPC/POPS bilayers onto DSPC/18:TAP monolayer without PEG brushes (blue), with PEG 2k (black) and with PEG 5k (green).

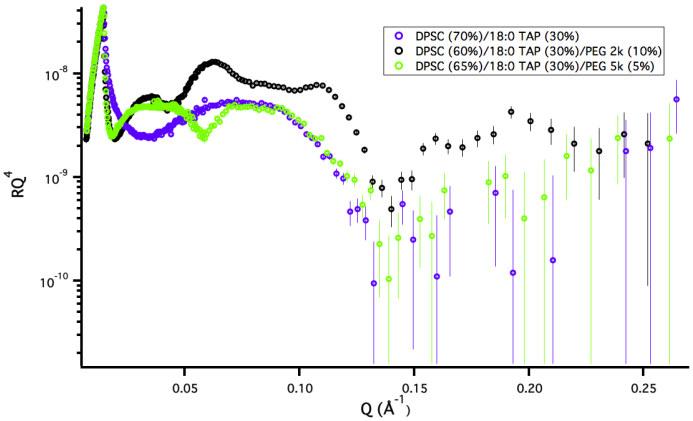

Figure 1: Reflectivity data obtained for POPC/POPS bilayers deposited onto functionalized surface by DSPC/18:0 TAP monolayer with and without PEG brushes.

It is evident how the presence of PEG brushes produces different interference patterns and therefore minima in the reflectivity data. In all the data is clear the signature of the first monolayer on OTS (minimum at 0.15 $Å^{-1}$) and, for the samples with PEG brushes, minima at lower Q values, proving the presence of a thick interlayer between the monolayer and the POPC/POPS bilayer. Data have not been fitted yet because modeling requires structures more complicated than expected. Data have been collected at different contrast as shown in Figure 2.

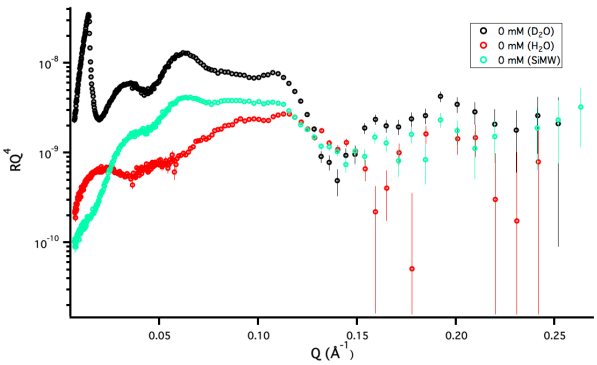

Figure 2: Reflectivity data obtained for POPC/POPS bilayers deposited onto functionalized surface by DSPC/18:0 TAP/DSPE PEG 2k monolayer at different contrast (D_2O (black), H_2O (red), *SiMW* (green)).

In addition, due to the opposite surface charge between the monolayer and the bilayer, reflectivity curves at different ionic strength have been collected. Results for the bilayer deposited onto PEG 2k in heavy water are shown in Figure 3.

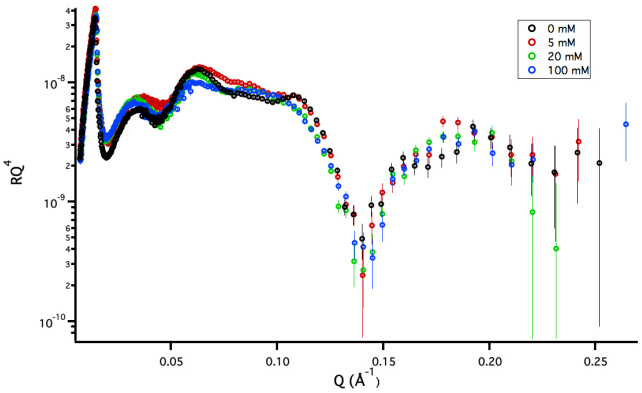

Figure 2: Reflectivity data obtained for POPC/POPS bilayers deposited onto functionalized surface by DSPC/18:0 TAP/DSPE PEG 2K monolayer at various NaCl concentrations (0 mM, 5 mM, 20 mM, 100 mM).