Experimental report

Proposal:	TEST-2592

Council: 4/2016

Title: Impact of Silica Nanoparticles on the Compression Modes of Phospholipid Membranes

Research area:

This proposal is a new proposal

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Samples: D2O
SiO2
C34D70C5H12O8PN

Instrument	Requested days	Allocated days	From	To
IN15	4	4	03/06/2016	07/06/2016

Abstract:

Experimental Report for Exp. Test-2592

March 13, 2017

We performed neutron spin-echo (NSE) measurements at IN15 on polyelectrolyte mediated multilamellar vesicles consisting of the double chain surfactant Rewoquat CR3099 and sodium poly acrylate (NaPA) to answer the question whether the membrane of such vesicles acts as a single, relatively rigid membrane or if the different layers in the membrane act as individual layers and retain the same bending elasticity as in a unilamellar vesicle.

Previous SANS measurements confirmed that the addition of relatively small amounts of NaPA to unilamellar vesicles formed by Rewoquat CR3099 transforms them into multilamellar vesicles where the addition of more NaPA increases the number of layers in the vesicles from 1 to 20 in the range of compositions we have investigated here.

The obtained NSE data was analysed using the Zilman-Granek model ($S(q,t) = \exp(-(\Gamma_{ZG}q^3t)^{2/3})$, with $\Gamma_{ZG} \propto \kappa^{-1/2}$, where κ is the bending elasticity of the membrane) and the measurements showed no significant change in the bending elasticity (see fig. 1) confirming that the layers in the multilamellar vesicles retain their flexibility and act as individual layers.

This is in contrast to measurements on polyelectrolyte mediated multilamellar vesicles using the rather stiff polyelectrolyte chitosan (see Exp. Rep. for TEST-2590) where a stiffening of the membrane was observed.
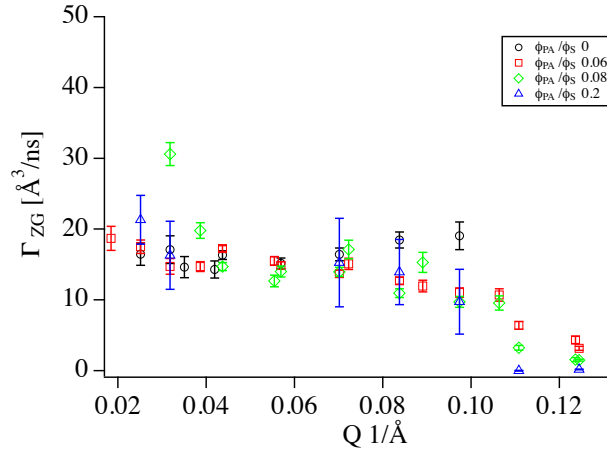
Figure 1: Γ_{ZG} obtained from fitting the Zilman-Granek model to the data. No significant change is observed despite the increase of the number of layers N from 0 for $\phi_{PA}/\phi_S = 0$ to 20 for $\phi_{PA}/\phi_S = 0.2$ where ϕ_{PA}/ϕ_S is the ratio of volume fractions between NaPA and the surfactant