Highlights

Advanced materials and techniques for organic electronics, biomedical and sensing applications - 2018

In-plane molecular organization of hydrated single lipid bilayers: DPPC: cholesterol

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Cell membranes are composed mainly of a mixture of lipids and proteins. Lateral segregation of membrane components into domains of lipids enriched in cholesterol (chol) and sphingolipids is involved in many membrane functions. Understanding the physical properties of cholesterol–phospholipid systems is essential to gain a better knowledge of the function of each membrane constituent. The aim of the present work is twofold: to propose a novel user-friendly setup based on a thin layer cell configuration that allows the successful acquisition of grazing incidence x-ray diffraction (GIXD) data on single lipid bilayers (SLBs) under aqueous conditions and to provide a further understanding of the DPPC:chol system.
The proposed set-up consist allows the confinement of the SLB in solution between two Si wafers. In this way the amount of extra liquid is minimised, limiting the background scattering from the solution and avoiding the evaporation of the solvent. The diffraction peak coming from the lateral organisation of the SLB can then be detected and studied as a function of sample and solution compositions.

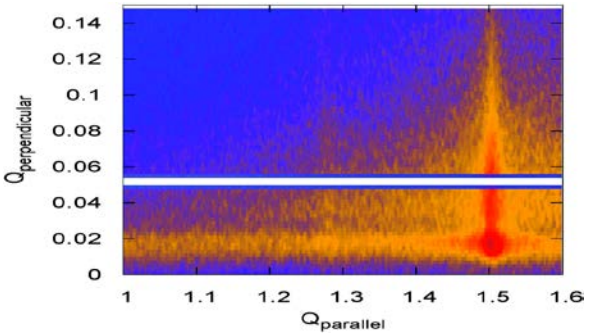

Fig. 1: Diffracted intensity 2D contour plot for a DPPC:chol (90:10 molar ratio) SLB in a Si–SLB–Si configuration, in 20 mM HEPES, 150 mM NaCl and 20 mM MgCl2 buffer solution pH 7.4, at room temperature. The white line parallel to $Q_{parallel}$ originates from the missing rows of pixels between 2 chips of the area detector.

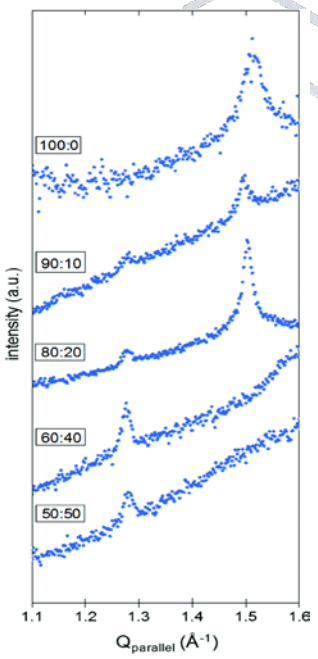

Fig. 2: GIXD $Q_{parallel}$ intensity patterns from DPPC:chol SLBs at different molar ratios. The the plots it appears clearly that the main correlation peaks shifts from 1.3 $Å^{-1}$ at low DPPC:chol composition ratios to 1.5 $Å^{-1}$ at high DPPC concentrations.