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In-situ analysis of the protein adsorption on solid-supported lipid layers

Biochemical processes at lipid membranes are essential for all living organisms and can be influenced by the interaction of proteins with lipid interfaces [1-2]. Hence, the effects of protein adsorption at such surfaces are important for understanding the organisms' biochemistry, for current issues in the pharmaceutical industry and for bio- and nanotechnology [3-5].
We studied the adsorption of the proteins ferritin and apoferritin at a hydrophobic solid/liquid interface with X-ray reflectometry at beamline BL9 of the synchrotron radiation source DELTA (Dortmund, Germany) [6,7] at an incident photon energy of 27 keV. The model system is a stable phospholipid bilayer of 1,2-dimyristoyl-sn-glycero-3-phosphocholine (DMPC) applied by spin coating on a silicon single crystal wafer [8].
To study the adsorption processes under the influence of pH and protein concentration at room temperature, the lipid layers are applied in an aqueous environment in a dedicated polytetrafluoroethylene sample cell.
Measurements on a DMPC layer with apoferritin show an increase in roughness, electron density and layer thickness of the head groups adopted to the Si/SiO2 surface. This suggests that the protein accumulates in this area. With higher protein concentration, structural changes in the whole lipid system can be recognized. Especially the roughness of the lipid layer increases.
A decrease in pH also causes a change in roughness and electron density. At low pH values, the layer thickness around the head groups at the SiO2 interface grows, which is explained by the conformational change of the protein [9]. In comparison, the alkyl chains maintain their length.
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