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Anonymous Gel-Fluid Transition of Solid Supported Lipids

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Abstract : Solid-supported lipid bilayers are often used as a simple model for studies of biological membranes. The presence of a solid substrate that interacts attractively with lipid head-groups is expected to affect the phase behavior of the supported bilayer. Molecular dynamics simulations of a coarse-grained model are thus performed to investigate the phase behavior of supported one-component lipid bilayer membranes. Our results show that the attraction of the lipid head groups to the substrate leads to a phase behavior that is different from that of a free standing lipid bilayer. In particular, we found that the phase behaviors of the two leaflets are decoupled in the presence of a substrate. The proximal leaflet undergoes a clear gel-to-fluid phase transition at a temperature lower than that of a free standing bilayer, and that decreases with increasing strength of the substrate-lipid attraction. The distal leaflet, however, undergoes a change from a homogeneous liquid phase at high temperatures to a heterogeneous state consisting of small liquid and gel domains, with the average size of the gel domains that increases with decreasing temperature. While the chain order parameter of the proximal leaflet clearly shows a gel-fluid phase transition, the chain order parameter of the distal leaflet does not exhibit a clear phase transition. The decoupling in the phase behavior of the two leaflets is due to a non-symmteric lipid distribution in the two leaflets resulting from the presence of the substrate.

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