Influence of polymer-vesicles interactions on the structure and dynamics

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Abstract

Many biological and technical processes rely on selective properties, e.g. to avoid contaminations. For example, cells are protected by membranes. Despite the continuous progress to understand the underlying fundamental mechanisms behind these barrier properties, constitutive equations that can generally describe these phenomena are still missing. In general, such models rely on assumptions about the structure and the dynamics of membranes at different length- and time-scales.

Microscopes can reveal a part of the information, such as the molecular structure of membranes by transmission electron microscope or the kinetics by optical microscopes, eventually with a resolution enhanced by selective fluorescence labelling. Despite the high resolution achieved, certain membrane properties are still beyond the resolution limit of optical microscopes and do not show a contrast to study them by a transmission electron microscopy. Furthermore, when molecular dynamics becomes important, typical time-scales of simulations are in the nanosecond regions, well outside the time windows that can be studied by microscopes.

All of these challenges can be solved, using neutron scattering techniques. Selective isotopic exchange of protons by deuterons gives a selective contrast to view the structures with sub-nanometer resolution. Neutron-spin-echo spectroscopy permits to study the dynamics in a broad time-scale region between ps and ns, well-fitting to the dynamic window of current simulations. Unlike other techniques, the structural and time dependent correlation function can be measured simultaneously.

The presentation reports recent progress in studying model membranes and its interactions with polymers by small-angle neutron scattering and neutron-spin-echo spectroscopy. It demonstrates that these techniques provide a valuable insight in the molecular motion of the involved constituents and provides an overview about future opportunities.