Interfaces, Interphases and Soft-Matter Dynamics

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Soft materials form structures at many different levels, from the molecular scale (≤ nm) well into the mesoscopic range (up to μm). Dynamical processes take place at all these length scales. Larger-scale rearrangements require longer times. Consequently, relaxation times ranging between picoseconds and years may be found. The multiple length and time scales cannot be captured with one single model and, therefore, hierarchies of models with different granularity have been developed. Whereas the mapping of structural parameters up and down the hierarchy is well developed, the transfer of dynamical properties is not. Current efforts to make multiscale models realistic also for soft-matter dynamics are the first central point of this talk.

The situation becomes even more challenging for soft matter at or near interfaces. The simple existence of an interface modifies the structure and dynamics of the material. The materials properties are locally different, and they converge to their bulk values only beyond a certain distance from the interface. The convergence depends not only on the material and the type of interface, but also on the quantity, which is monitored. The modification of soft-matter structure and dynamics near interfaces and the resulting so-called interphase is the second topic.

Examples include the evaporation dynamics of droplets from substrates, the polymerization of a reactive mixture (epoxy adhesive) at an interface, and the interphase defined by the local perturbation of the glass transition of a network.

Further reading:

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