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EINLADUNG

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über

"Hydrodynamics in Colloid and Interfacial Systems"

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“Hydrodynamics in Colloid and Interfacial Systems”

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Hydrodynamics is of a great importance for many systems which traditionally belong to the field of colloid and interface science. Below two examples are given where a balanced accurate description of both hydrodynamics and colloidal or interfacial phenomena is crucial for correct understanding of essential features of processes.

As the first example the Brownian dynamic simulation of time evolution of a colloidal suspension is considered. A correct description of aggregation/disaggregation processes requires an accurate estimation of the residence time of particles in a potential well what is possible with a model based on the Langevin equations, accounting for inertia, Brownian, hydrodynamic and colloidal forces. The model enables a correct prediction of the diffusion coefficient of a single particle, the residence time of a particle in a doublet and the average kinetic energy of any particle in an ensemble of interacting particles. The last means that there is no artificial pumping of energy either into or out of the system.

The numerical simulations allow to follow the kinetics of clustering in colloidal suspensions depending on the solid volume fraction, the potential well depth and the range of colloidal forces. The results of numerical simulations have confirmed that one of the possible mechanisms of quasi-stable clusters formation in colloidal suspensions observed experimentally is the reversible aggregation in a relatively shallow potential well.

The second example is the development of Marangoni instability accompanying the surfactant transfer and adsorption at a free liquid interface. There are systems demonstrating an oscillatory behavior instead of stationary convection predicted by linear stability analysis. The mechanism governing the oscillations in these systems can be understood on the basis of direct numerical simulations of their time evolution. It has been shown that instability develops initially as quasi-stationary convection according to the criteria based on the linear stability analysis. However a steep increase of the interfacial velocity results in a very quick compression of the adsorbed surfactant monolayer what causes termination of instability. Instability develops again when sufficiently large concentration gradients are reestablished in the system. Thus the oscillations in these systems are the result of convective instability periodically arising and terminating.