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Transport of Colloids in Multiphase Systems

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The mobility of colloids is partly controlled by filtration effects. In saturated porous media colloid–matrix interactions and dynamic properties are responsible for attachment and detachment processes. In the unsaturated zone, or if non-miscible fluids are present, the air-water interface and the water-fluid interface add to the complexity of the colloid transport phenomena.

The colloid processes at the interfaces in multiphase systems were examined on a single-particle level using micromodels. Four different sizes of fluorescent colloids were used in homogeneous and heterogeneous pore structures. n-Octanol was used as a non-miscible phase in the saturated experiments. Experiments in unsaturated micromodels were run at different ionic strength and with varying pH-value. Experiments were run under flow and under no-flow (i.e. diffusion only) conditions.

Imaging results show that colloids are preferably captured at the various interfaces (air–water, air–water–matrix, water–octanol). Attachment to the water matrix interface was less important. Dissolving gas bubbles caused a sudden release of colloids. Capillary effects influencing the mobility of colloids were observed under unsaturated conditions. The attachment to the water–octanol interface depends on the surface functional groups of the colloids. The quantification of these processes is in progress.