Visualization of Colloid Transport in a PDMS micro-model with Confocal Microscopy

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Key words: Visualization, Colloid transport, PDMS micro-model, Confocal microscope

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Considerable attention has been paid to the colloid transport in both saturated and unsaturated porous media. In order to get direct observation of colloids behavior, pore scale visualization experiments have been employed. Recently, micro-models have been used often as efficient tools for the study of colloid transport in porous media. In this work, a PDMS micro-model with overall network dimensions of 1*mm* x 10*mm* and mean pore size of 30μm was constructed and employed. Carboxylated fluorescent microspheres (300*nm* diameter) were used as model colloids. Their movement in the model was visualized with a confocal microscope. Static experiments under both water-saturated and partially-saturated conditions were conducted. We were able to obtain high quality images of colloids. Dynamic experiments (drainage/imbition) were also carried out. In two-phase flow experiments, due to the intrinsic hydrophobicity of the model surface, fluorinert was regarded as the wetting phase; water acted as the non-wetting phase. In these experiments, first we introduced either water or fluorinert into the model for an extended period in order to expel the gas phase. Then, the second phase was injected. Sequential confocal microscope images were analyzed to visualize the retention of colloids at solid-water interface, fluorinert-water interface, and fluorinert-water-solid contact line. Images under drainage/imbibition conditions were used to quantify detachment of deposited colloids as a function of water content. Our visualization results provide valuable information for improving our understanding of mechanisms of colloid transport, retention and mobilization.