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The filtration of colloidal gold nanoparticles with carbon nanotubes FRANS JAN DE JONG, Hamburg University of Technology (Hamburg, Germany), ADELINE BUFFET, German Electron Synchrotron (Hamburg, Germany) — Understanding the local filtering of nanoparticles (NPs) is essential for the development and optimization of medical and industrial applications. Microfocus small-angle X-ray scattering (μ SAXS) was used to determine the local filtration kinetics of 100 nm sized colloidal gold nanoparticles (Au NPs) within a multi-walled carbon nanotube (MWCNT) forest. To get a physical insight into the Au NP filtration process within the MWCNT forest a novel model based on the well-known DLVO theory was developed. The DLVO theory is commonly used to describe the interaction between colloidal particles. In addition to the attractive Van de Waals force and the electrostatic double-layer force, a non-DLVO force is added to account for hydration and hydrophobic effects. The model presented here shows that the Au NPs are mainly unfavorably deposited into the so-called secondary energy minimum. This latter finding is in good agreement with the experimental observations and the literature, in which unfavorable particle deposition is related to deposition into the secondary energy minimum. The use of μ SAXS to get a physical insight into the local deposition kinetics of submicrometer particles opens up new pathways to optimize the preparation of MWCNT forests for filtration purposes.

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