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Desorption kinetics of ssDNA from SWNTs

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We have studied the kinetics of desorption of single strand DNA oligomers from colloidal dispersed single-wall carbon nanotubes by fluorescence spectroscopy. We do so by monitoring the rate of desorption from SWNTs after submitting an equilibrated ssDNA-SWNT suspension to a concentration step by which excess ssDNA is removed from the suspension. The concentration of desorbed ssDNA is determined using fluorescence from a marker attached to the ssDNA.

Temperature-dependent desorption measurements allow to carry out an Arrhenius analysis. Binding energies obtained from this reveal surprisingly small activation energies of only (70±10) kJ mol^{-1} for FAM-$(GT)_n$ oligomers with n=12,16. Such small activation energies are typically associated with adsorbate residence times on the order of a fraction of a second to seconds at best. The ssDNA-SWNT conjugates studied here however are stable over hours and days even if excess DNA is removed from the suspension. This indicates that the conjugates are not stabilized energetically but kinetically. We discuss how such a kinetic stabilization may arise and how the proposed mechanism can be tested. In addition we also present the design and setup of an experiment which allows to routinely investigate desorption of different types of fluorescently labeled ssDNA oligomers from SWNTs.