Diffusion of DNA polymer molecules in nanochannels

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DNA molecules can be transported in a nanochannel with help of electrophoretic and hydrodynamic flow. Transport experiments and theoretical considerations point to an interaction of electrophoresis, electro-osmosis, and the unique statistical properties of confined polymers. The confinement of the device also plays a crucial role by influencing the electric fields in the nanochannel [1].

Nanofluidic channels in polydimethylsiloxane (PDMS) were formed by classical nanoimprinting technology combining micro- and nanofluidc features. We circumvent small aspect ratios by superimposing a permanent layer of the heat curable varnish SU-8 for the micrometer wide entrance channels. The utility of the hybrid micro- and nanofluidic PDMS structures for single molecule observation and manipulation was demonstrated by introducing single molecules of λ-DNA into the channels using optimized conditions for the applied potential and flow [2].

Manipulation of transport was successfully demonstrated with PDMS nanochannels with a cross section ≤ 1 µm observed by using epifluorescence video microscopy. Once stabilized inside a nanochannel the free diffusion of individual λ-DNA molecules could be observed. Diffusivity was compared with previous studies that concentrated on nanoslits and checked for adaptability to blob theory and reflecting rod theory [3].

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