

Goals and Potential Impact if Successful

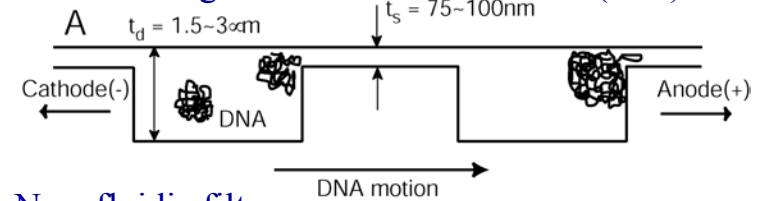
Development of Nanofluidic Molecular Sieves and Filters for Biomolecule Separation, as an alternative of random, nanoporous molecular sieving materials

- Molecular sieving by regular nanostructures (precise control and optimization possible)
- Better robustness than polymeric nanoporous materials
- Easier Integration into higher-level BioMEMS devices

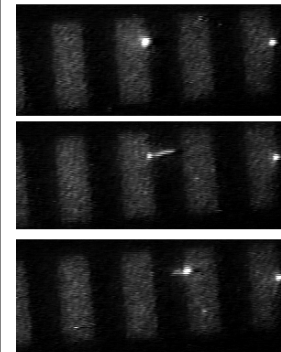
Potential Impacts

- (1) Smart nanofluidic molecular filter that can replace porous membranes in diverse applications
- (2) New molecular transport phenomena at the nanoscale could lead to better molecular sieving / filtering / control

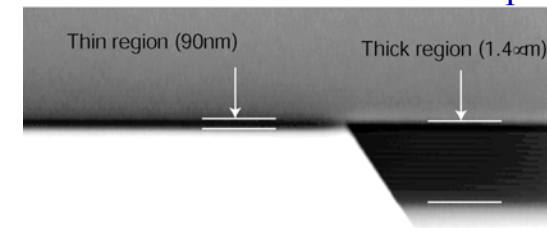
DNA Sieving with Nanofluidic Filters (Han)



DNA in Nanofluidic filters



Fabrication of Nanofluidic Gaps



Approach and/or Accomplishments

Development of Nanofluidic filters

- Fabricate nanofluidic molecular filter devices with 10-100nm critical dimension
- Test molecular separation techniques based on the hindered transport of various biomolecules, including proteins and DNA.

Study of molecular stochastic motion at nanoscale

- Study the molecular stochastic motion in nanochannels (10-100nm) using fluorescence correlation spectroscopy(FCS)
- Investigate the effect of Debye layer thickness, hindered transport of molecules in confined space

Bottlenecks and Open Research Questions

-Computational (stochastic) modeling of molecular transport through nanofluidic filters or similar-sized molecular sieving systems : Continuum-based modeling generally breaks down at this size scale, and computationally expensive methods are sometimes required.

-Characterization of ultra-thin nanochannels: Roughness, Thickness, Surface Chemistry (or control of it)

-Science of molecular diffusion / transport in small dimension is not clear yet