Nanofluidics in carbon nanotubes

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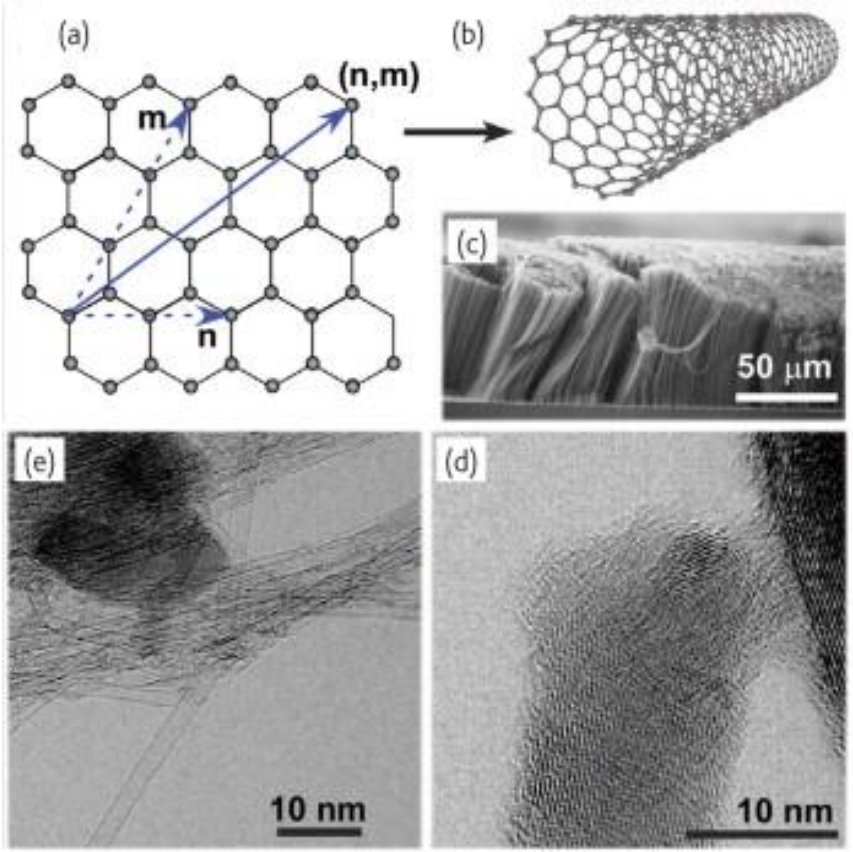
Basic structure and Properties of CNTs



- Rolled-up graphene

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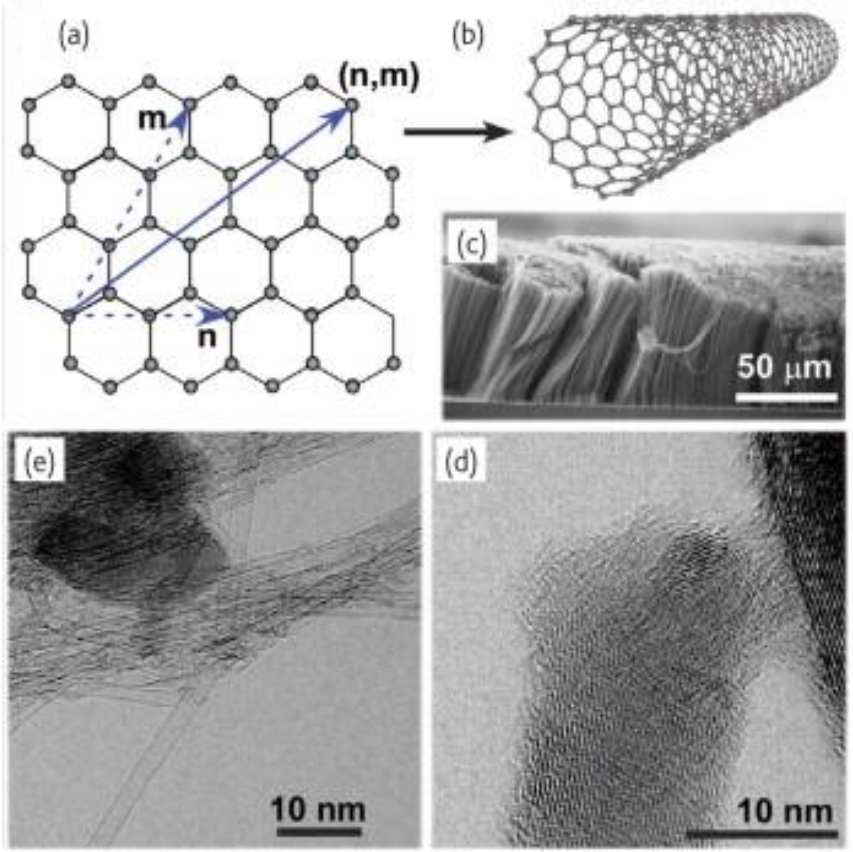

- Rolled-up graphene
- Characterized by its roll-up vectors (n,m)

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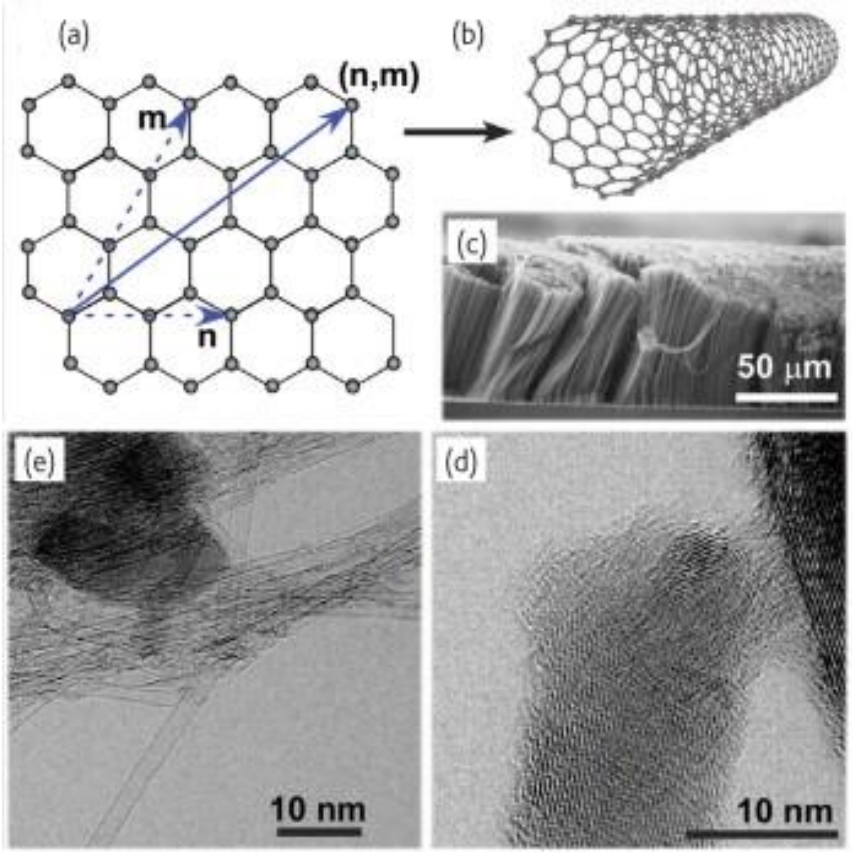

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- Characterized by its roll-up vectors (n,m)
- Atomic scale smoothness

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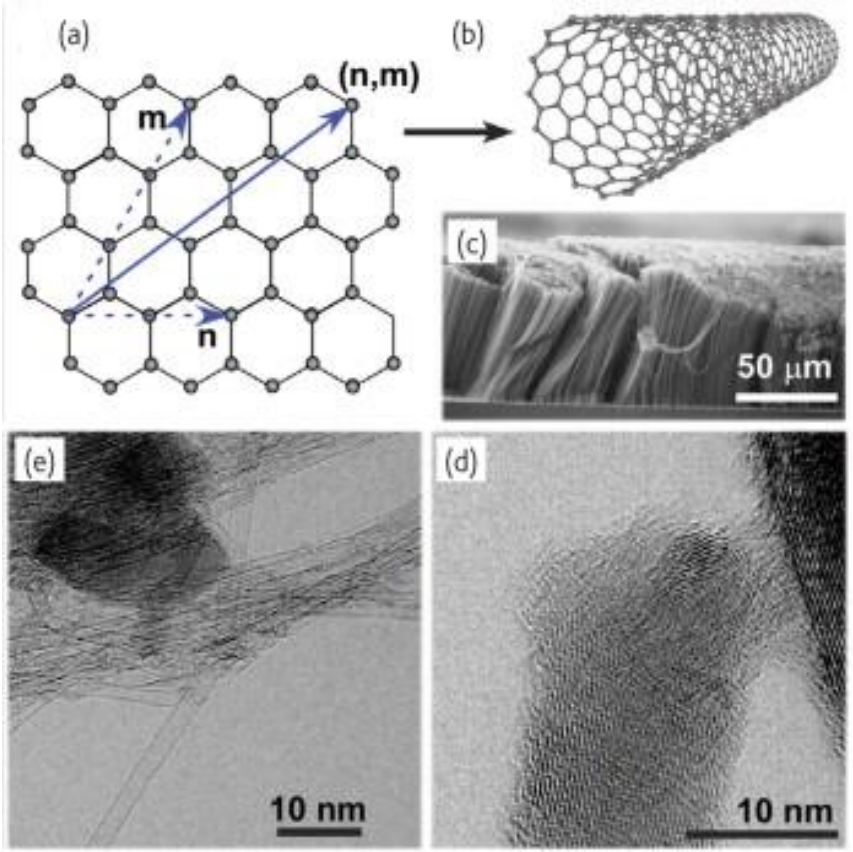

- Rolled-up graphene
- Characterized by its roll-up vectors (n,m)
- Atomic scale smoothness
- Chemical vapor deposition (CVD) is prefered production method

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Simulation of water and gas in CNTs

Questions:

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Answer

Molecular Dynamic Simulations !!!

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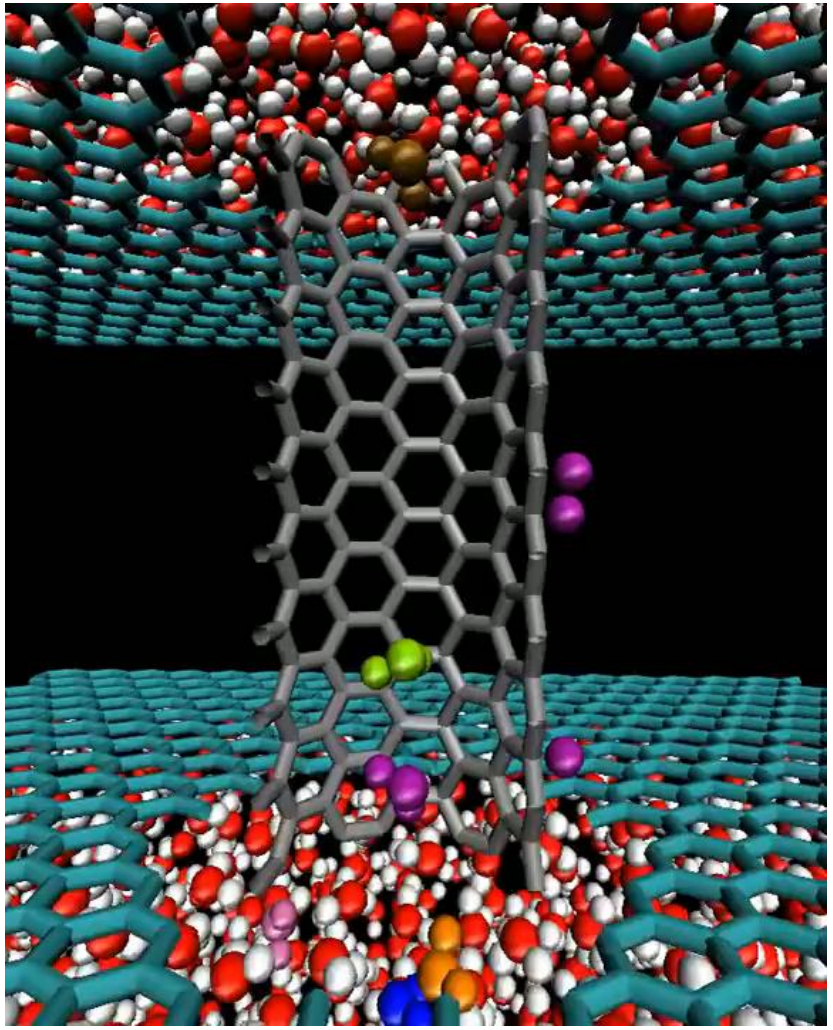

https://www.youtube.com/watch?v=9L-SfLwBbto

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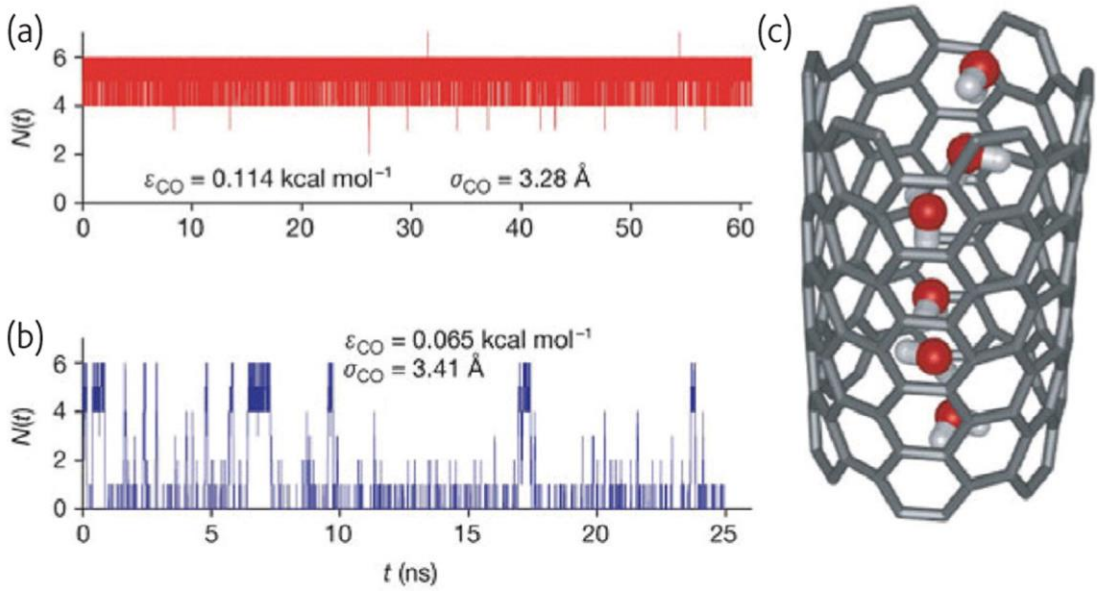

- Water enters the CNTs (increased degree of freedom)
- High rate of water transport (5.8 molecules/ns)

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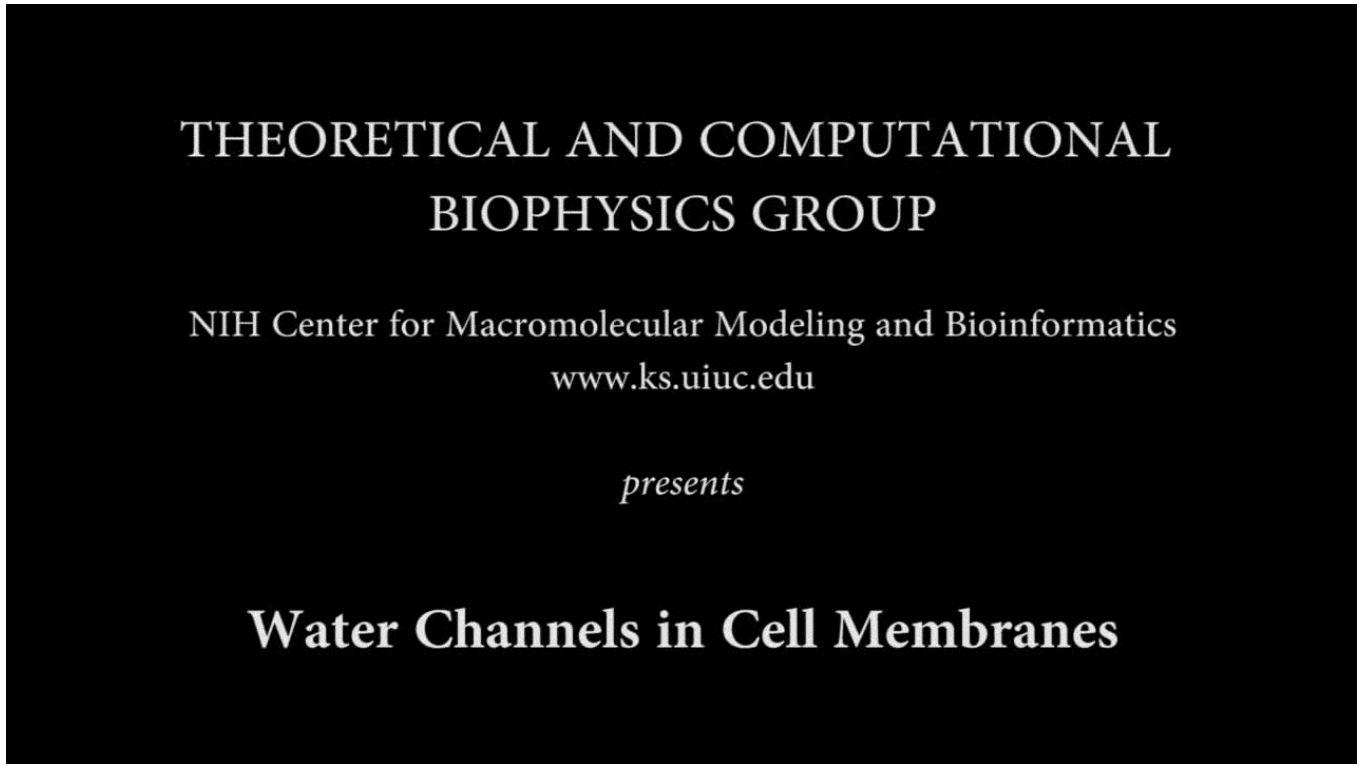
Analogy to aquaporins



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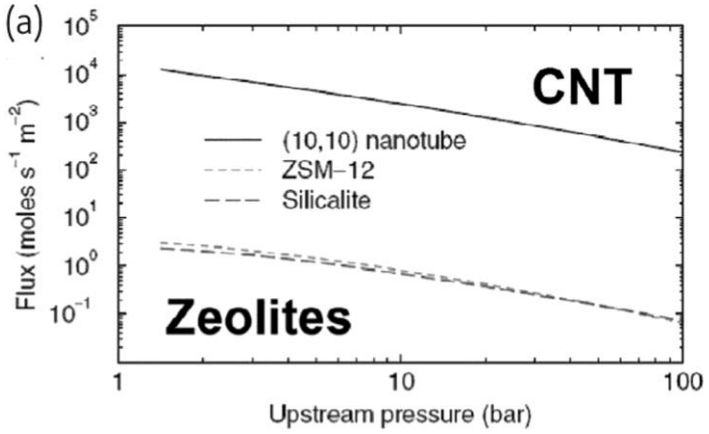

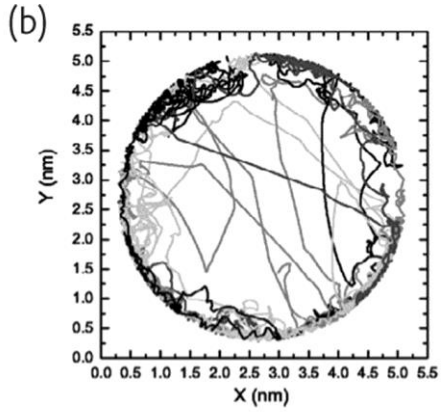

- Ballard-ball like propagation
- Gas transport is three orders of magnitude higher compared to similar porous membranes

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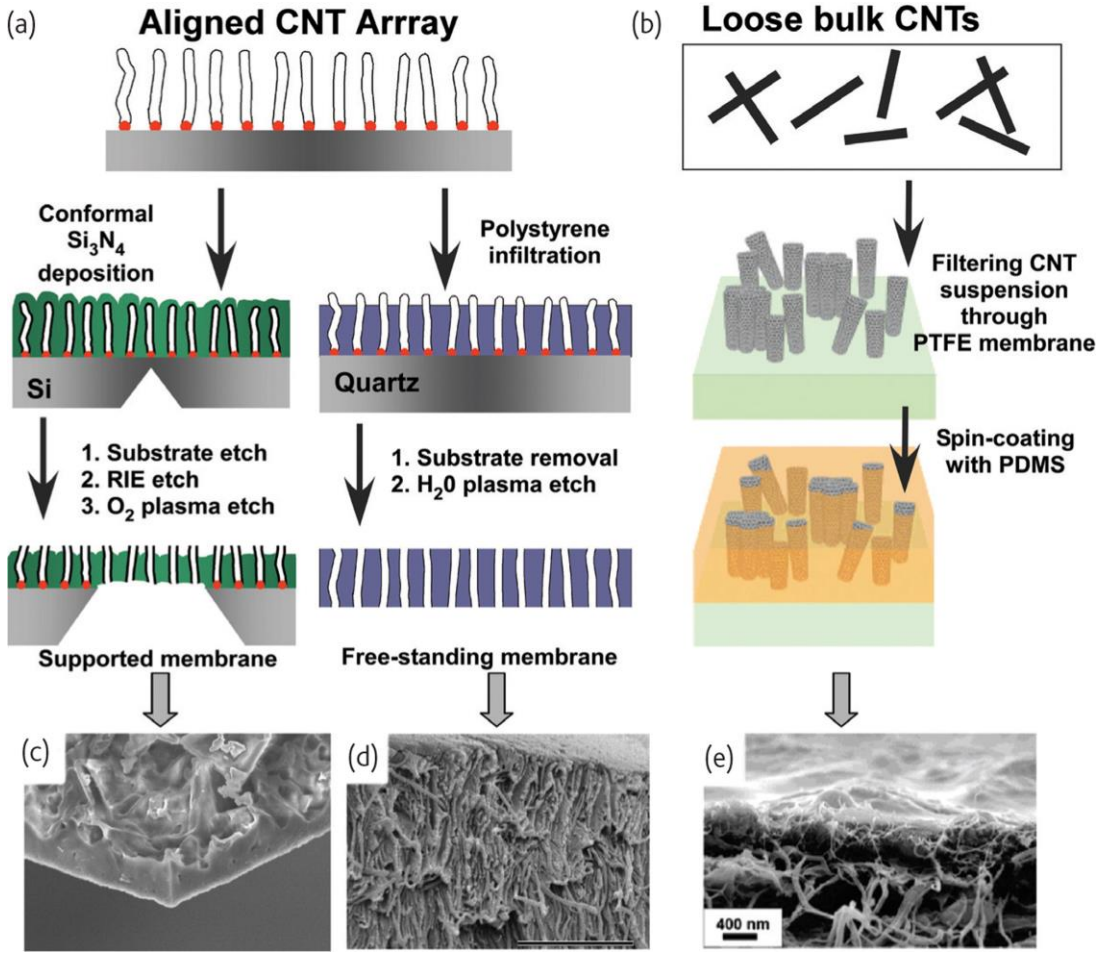
Fabrication of CNT membranes



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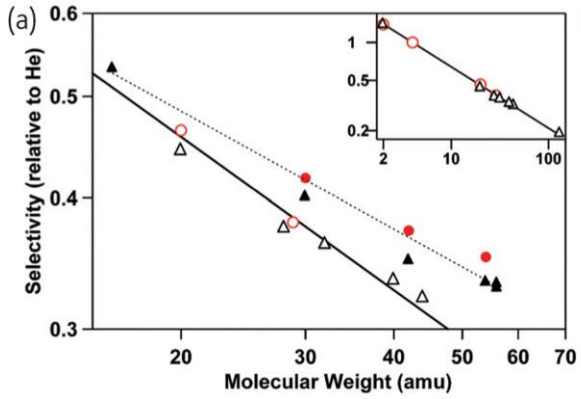
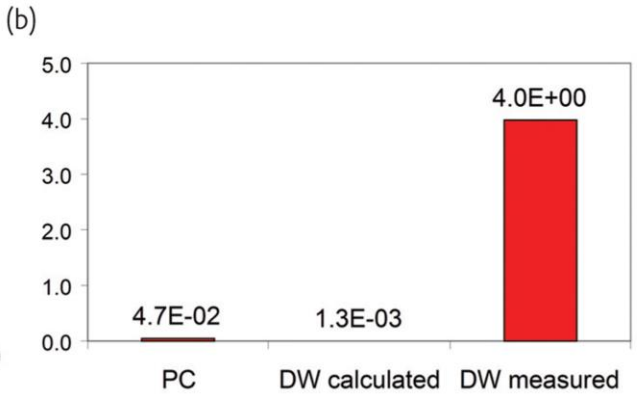
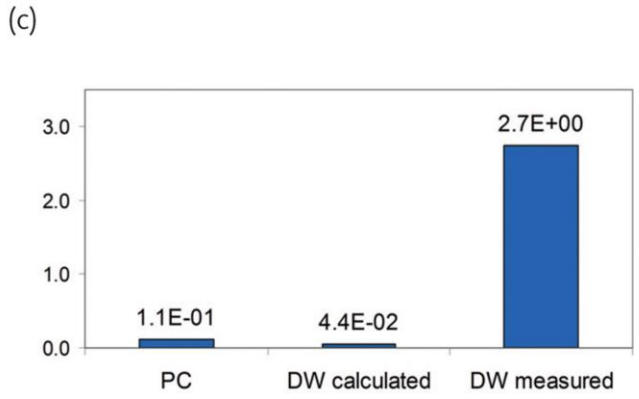
Gas and water transport measurements





Water flux



Air flux

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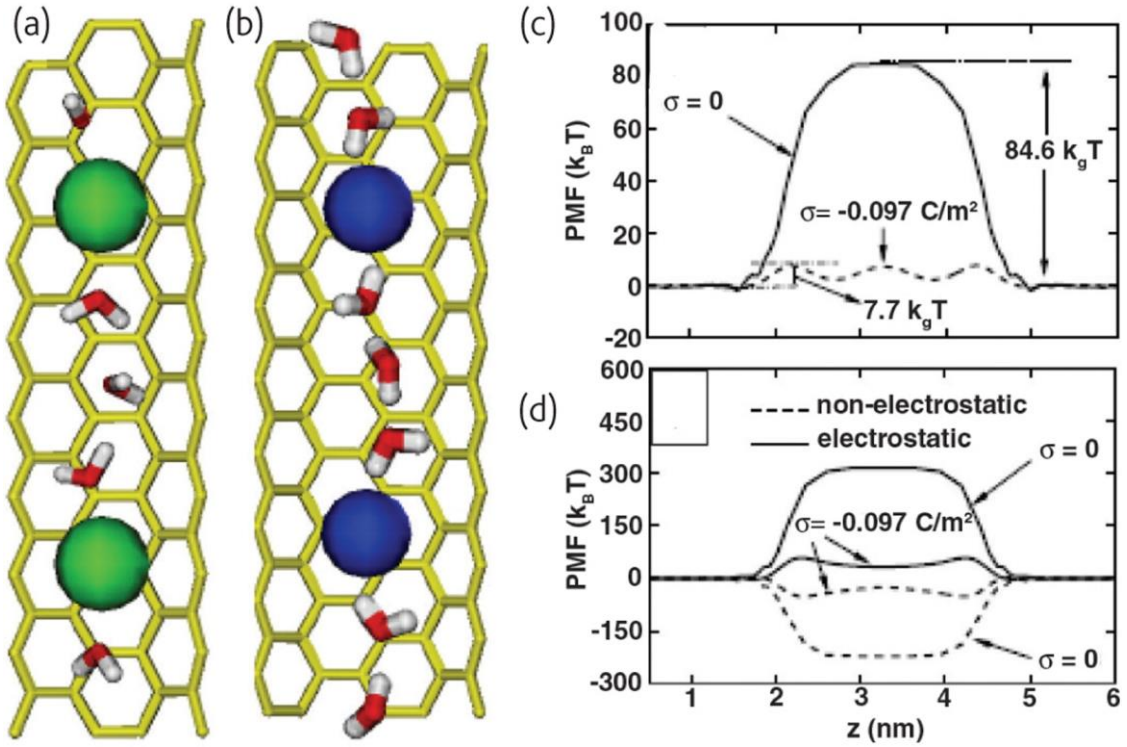
Nanofiltration and ion exclusion



- Fast filters due to high water transport
- Charging of the CNTs leads to ion exclusion
- Modification of the CNTs ends

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Thanks to your attention

- Questions???