Plasmonic Nanopores for Bioanalytical Sensing

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Solid-state nanopores and plasmonic nanoantennas are two concepts that both have shown valuable for manipulation and investigation of biomolecules and biomolecular interactions, down to the level of single molecules. Nanopore sensing is based on monitoring biomolecular-induced changes in the ionic conductance of an around 10 nm in diameter pore in a thin solid-state membrane. Plasmonic nanosensors instead utilize that the resonance condition for excitation of plasmons in metal nanostructures is highly sensitive to changes in refractive index close to the nanostructure, as, for example, induced by biomolecular binding reactions. In addition, the excitation of these collective electron oscillations known as plasmons also provides a means to focus and localize light to sub-diffraction limited spots with highly intense electromagnetic fields. Some of the most fascinating applications of such hot spots include surface-enhanced Raman scattering and optical nanotweezing.

In our recent work we combine nanopores and plasmonic nanoantennas into one concept termed *plasmonic nanopores* (see example in Figure 1). I will discuss how plasmonic nanopore systems can be used to significantly improve nanoplasmonic sensing by using the nanofluidic pores for efficient delivery of target molecules.[1,2] Vice versa, nanopore sensing could be improved using plasmonic effects, where I will focus on the possibility to control biomolecular translocations using optical forces provided by plasmonic nanoantennas. As an example of a conceptually new application I will present our recently developed optical profiling method based on light-induced plasmonic heating in a single plasmonic nanopore.[3]

References

[1] M.P. Jonsson et al., Analytical Chemistry, **82** (2010) 2087-2094.
[2] F. Mazzotta, F. Höök and M.P. Jonsson. Nanotechnology 2012, **23** (2012), 415304
[3] M.P. Jonsson and C. Dekker. In revision

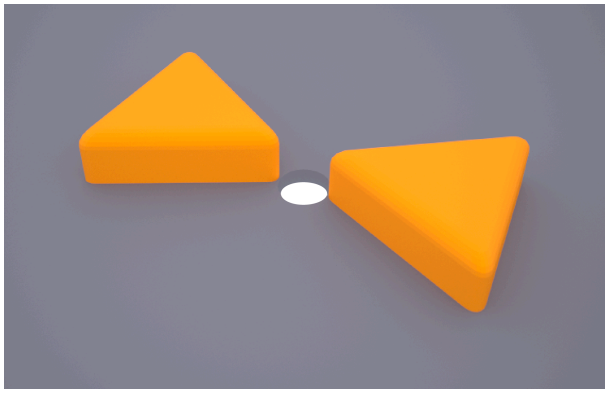

Figure 1. Schematic example of a plasmonic nanopore, composed of gold bowtie nanoantenna (yellow) on a thin solid-state membrane (grey) with a nanopore at the gap centre (white).