Macromolecular Gates on Plasmonic Nanopores

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There is a steady need for new methods to detect and analyze biomolecules. In this project we combine plasmonic nanopores[1] and polymer brushes with the long-term aim to develop new bioanalytical devices. Meanwhile we also address fundamental questions on the behavior of macromolecules and supramolecular chemistry, such as interactions (or just repulsion) between proteins and synthetic polymer chains.

I will show recent results of plasmonic nanopores sealed by polymer brushes[2] that either repel or attract proteins. Such pores enable new types of biomolecular filters whose properties are determined by the brush (and not the pore). The filters may, in turn, improve the performance of plasmonic sensors when operating in complex media. I will also describe different ways to achieve "gating", i.e. morphology changes in the brush which makes the closed nanopores permeable to proteins on demand.[3] This could have applications in single protein analysis by content control in volumes as small as one attoliter.

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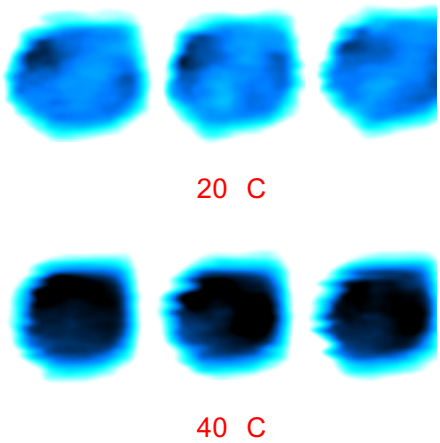

Figure 1 High speed AFM snapshots of a plasmonic nanopore functionalized with a poly(N-isopropylacrylamide) brush at different temperatures.

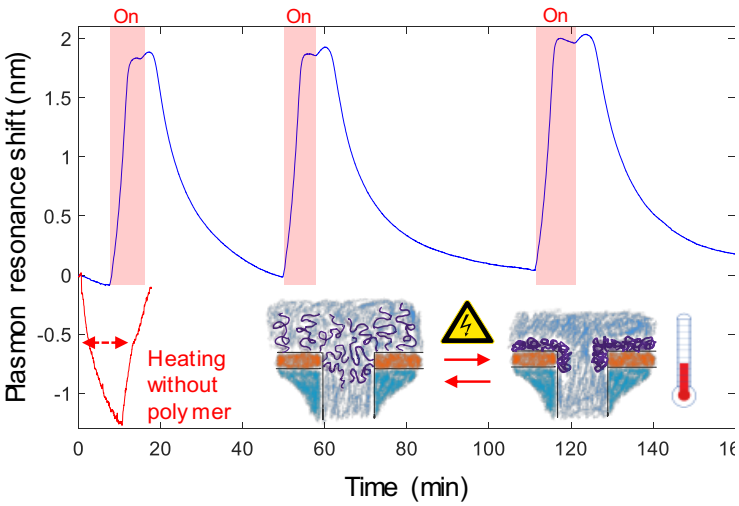

Figure 2 Plasmon resonance shift due to brush collapse induced by resistive heating of the gold film with nanopores.

[1] A.B. Dahlin. Analyst 2015, 140 (14), 4748-4759.
[2] G. Emilsson et al. Nanoscale 2018, 10 (10), 4663-4669.

[3] G. Emilsson et al. ACS Central Science 2018, 4 (8), 1007–1014.