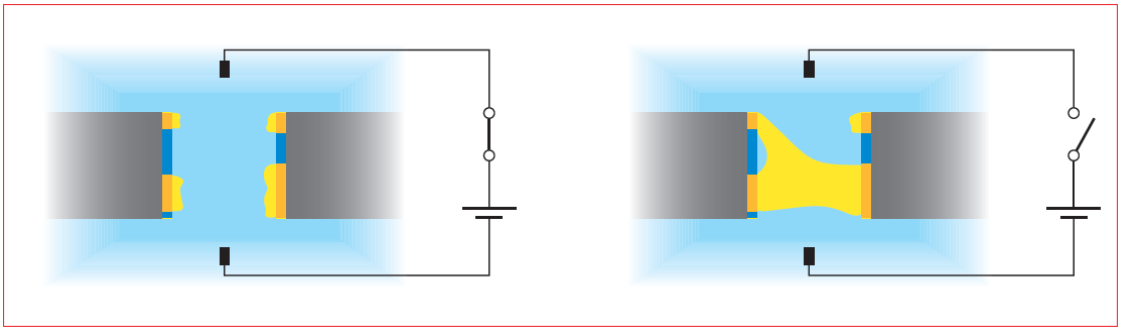
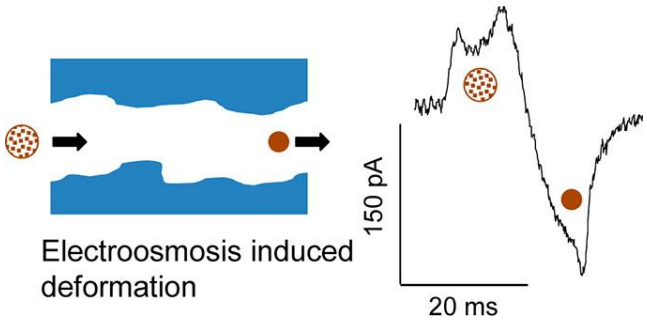
“Electric-field-induced wetting and dewetting in single hydrophobic nanopores” Matthew R. Powell1, Leah Cleary, Matthew Davenport, Kenneth J. Shea and Zuzanna S. Siwy, *Nature Nanotechnology*, **2011**, *6*, 798-802.



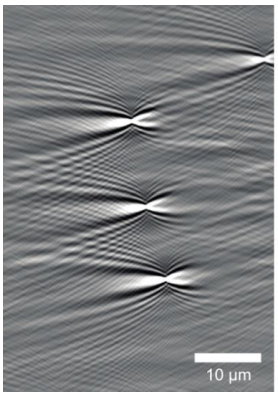
Wetting and dewetting in hydrophobic nanopores. **a**,**b**, The surface of the nanopore is covered by a patchwork of hydrophobic (dark yellow) and hydrophilic (dark blue) areas. The hydrophobic patches can act as nucleation sites for the formation of nanoscale gas bubbles (light yellow; **a**), which can extend across the entire nanopore and disturb the flow of liquid (pale blue) through the nanopore (**b**). Applying an electric field across the membrane helps the nanopores to fill with liquid (**a**), which means that the wetting and dewetting process can be regulated by an external voltage.

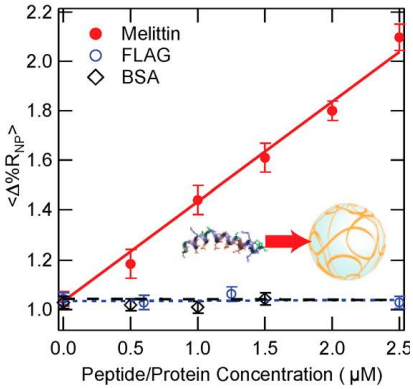
"Particle Deformation and Concentration Polarization in Electroosmotic Transport of Hydrogels Through Pores" Matthew Pevarnik, Matthew Schiel, Keiichi Yoshimatsu, Ivan Vlassiouk, Kenneth J. Shea, Zuzanna S. Siwy, *ACS Nano*, **2013**, 3720 - 3728.



In this article, we report detection of deformable, hydrogel particles by the resistive-pulse technique using single pores in a polymer film. The hydrogels pass through the pores by electroosmosis and cause formation of a characteristic shape of resistive pulses indicating the particles underwent dehydration and deformation. These effects were explained *via* a non-homogeneous pressure distribution along the pore axis modeled by the coupled Poisson–Nernst–Planck and Navier–Stokes equations. The local pressure drops are induced by the electroosmotic fluid flow. Our experiments also revealed the importance of concentration polarization in the detection of hydrogels. When an electric field is applied across the membrane, a depletion zone can be created in the vicinity of the particle observed as a transient drop of the current. Our experiments using pores with openings between 200 and 1600 nm indicated the concentration polarization dominated the hydrogels’ detection of pores wider than 450 nm. The results are of importance for all studies that involve transport of molecules, particles, and cells through pores with charged walls.

"Monitoring Peptide Uptake in Single Hydrogel Nanoparticles with Near Infrared Surface Plasmon Resonance Microscopy," Kyunghee Cho, Jennifer B. Wood, Keiichi Yoshimatsu, Kenneth J. Shea and Robert M. Corn*, *Analytical Chemistry*, **2015**, *87*, 4973–4979.





This paper describes how changes in the refractive index of single hydrogel nanoparticles (HNPs) detected with near-infrared surface plasmon resonance microscopy (SPRM) can be used to monitor the uptake of therapeutic compounds for potential drug delivery applications. As a first example, SPRM is used to measure the specific uptake of the bioactive peptide melittin into *N*-isopropylacrylamide (NIPAm)-based HNPs. Point diffraction patterns in sequential real-time SPRM differential reflectivity images are counted to create digital adsorption binding curves of single 220 nm HNPs from picomolar nanoparticle solutions onto hydrophobic alkanethiol-modified gold surfaces. Additional bulk fluorescence measurements of melittin uptake into HNPs are used to estimate that a 1% increase in $\langle \Delta\%R_{NP} \rangle$ observed in SPRM corresponds to the incorporation of approximately 65000 molecules into each 220 nm HNP, corresponding to roughly 4% of its volume. The lowest detected amount of melittin loading into the 220 nm HNPs was an increase in $\langle \Delta\%R_{NP} \rangle$ of 0.15%, corresponding to the absorption of 10000 molecules.