Supporting Information
Biosensing with Nanofluidic Diodes

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■ tip modified with 2-Methoxyethylamine
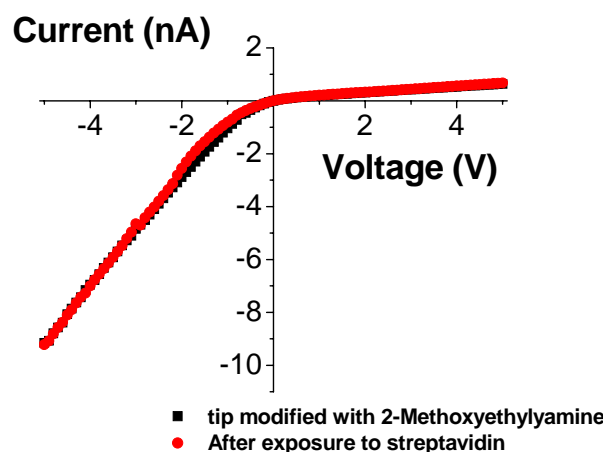● After exposure to streptavidin

Figure S1. Studies of the effect of non-specific adsorption on the functioning of a sensor detecting streptavidin (Fig. 8 in the main manuscript). The tip of the pore was modified with 2-methoxyethylamine, which is known not to bind streptavidin. Current-voltage curves were recorded in 10 mM KCl, pH 5.5 before exposure to streptavidin (■), and after exposure to streptavidin (●). Current-voltage curve of this pore did not change upon exposure to streptavidin, suggesting that non-specific interactions of the protein with the pore walls do not influence functioning of the sensor. The tip opening of this pore was 60 nm in diameter.
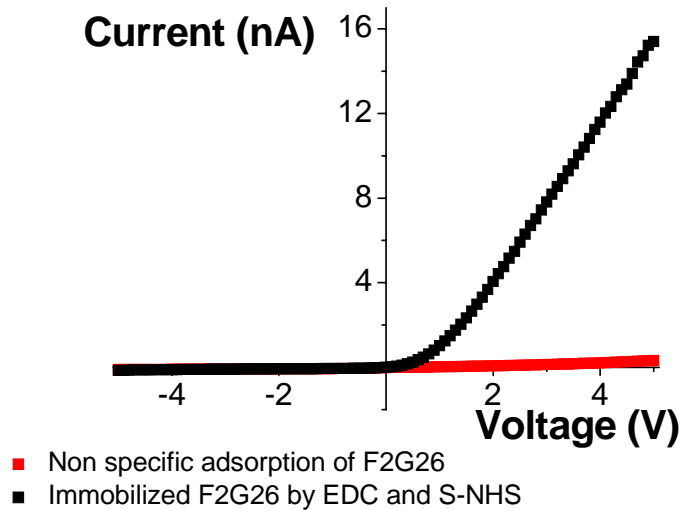
Figure S2. Studies of non-specific adsorption of the antibody F2G26 onto etched polyethylene terphthalate nanopores. Red squares (■) show a current-voltage curve that was recorded in 10 mM KCl pH 4.0 in a nanopore that was exposed to F2G26. The pore was not chemically modified thus its pore walls were covered with carboxyl groups. The observed change in the current-voltage curve is due to non-specific adsorption (presumably by electrostatic forces) of F2G26 on the carboxylated surface. The immobilization of F2G26 on the nanopore walls using covalent linkage results in much higher surface densities of F2G26 and thus much larger rectification and magnitude of currents at positive voltages (data shown as black squares ■).
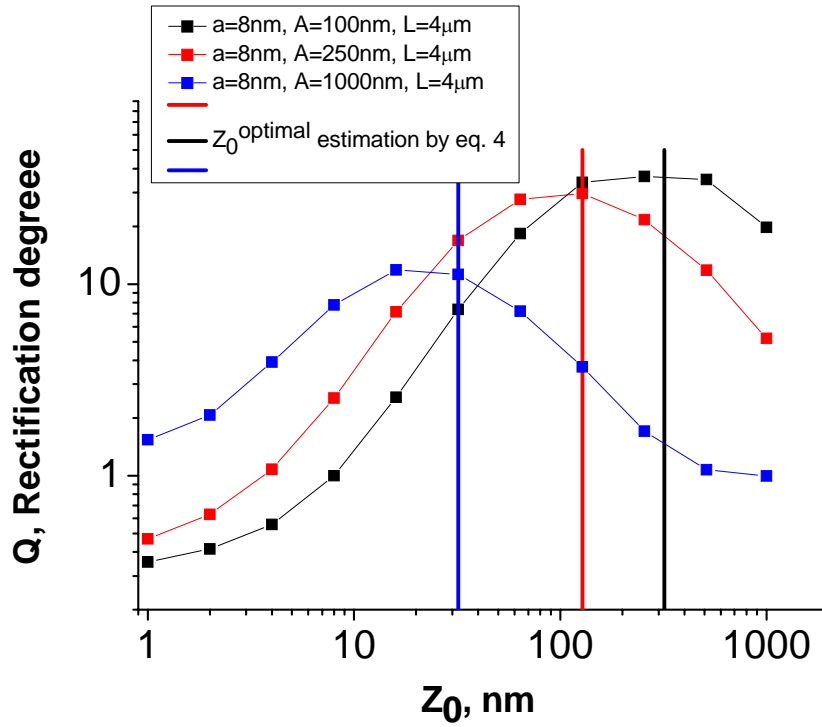
Figure S3. Calculations of the rectification degree of a bipolar diode by numerical solving of the Poisson-Nernst-Planck (PNP) equations. The rectification degree is plotted as a function of the location of the transition zone z_0, thus the position where the surface charge switches its sign. The PNP calculations were performed for the diode length of $L = 4\mu m$ and for different base radii, A. Solid lines show estimation of the optimal transition zone location $z_0^{optimal}$ using Eq. (4) in the main manuscript. This figure shows that Eq. 4 indeed provides good estimates for $z_0^{optimal}$ even for shorter pores.
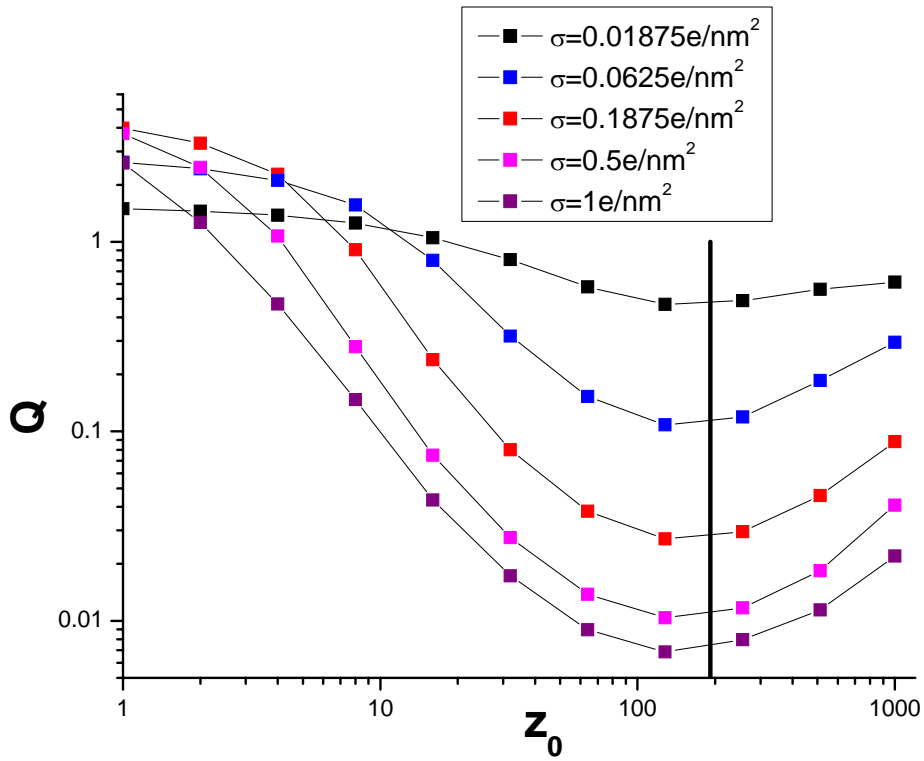
Figure S4. Poisson-Nernst-Planck calculations of rectification ratio, Q at $\pm 1V$ as a function of the transition zone position z_0 and σ for a conical BP diode with $a=4$nm, $A=250$nm, $L=12\mu$m and $C_{bulk}=0.1$M. Black solid line shows estimation of the optimal z_0 by Eq. 4 of the main manuscript. Note that $z_0^{optimal}$ does not depend on the surface charge density.