Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Precise control of DNA recapture in solid-state nanopore[1] YING HU, ZHI ZHOU, XINYAN SHAN, ZHI XU, XUEDONG BAI, XINGHUA LU, None
— Solid-state nanopore is a novel experimental method in detecting and analyzing single biomolecules such as DNA, protein and virus. The dynamic behavior of such molecules in a microfluidic system can be investigated by the back-and-forth translocation control. Such motion control is made possible by fast changing of the polarity of the driving voltage, and the repeat measurement of a single molecule is expected to increase the signal-to-noise-ratio (SNR) significantly. However, due to the existence of membrane capacitance and electrolyte resistance, transient current spike raises as driving voltage changes. Such current spike saturates the data acquisition system and leads to difficulty in detecting fast returned molecules. Simulation shows that the electric field in electrolyte is proportional to the ionic current and increases dramatically during the transient charging period. This extra electric force pulls the molecule back to the pore faster than expected. Our study demonstrates that the transient current can be compensated by modifying the profile of the driving voltage. With such improvement, the observed distribution of recaptured translocation events matches perfectly with the prediction by drift-diffusion transport equation. This finding will help building precise control technique towards DNA sequencing in nanopore.

[1]Supported by the National Basic Research Program of China under Grant No 2012CB933002 and the Strategic Priority Research Program (B) of the Chinese Academy of Sciences under Grant No XDB07030100.

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None

Date submitted: 12 Nov 2014 Electronic form version 1.4