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ナノピペットによるイオン選別検出法の改良

Improvement of ion-selective detection method with nanopipette

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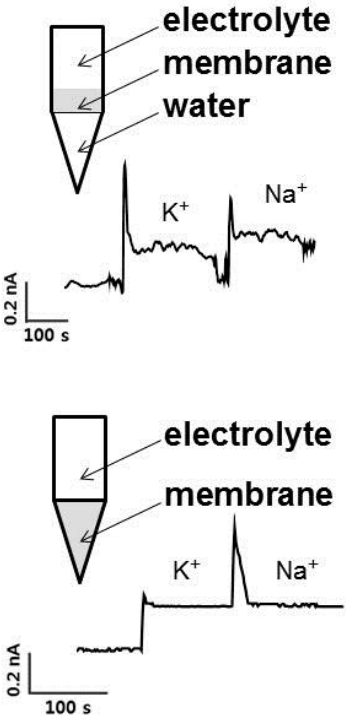
Ion-selective electrode (ISE) is widely used to detect aimed ions in solution.[1] Application of this method to nanoscale area detection using nanopipette requires different detection system because the usual detection system measuring electromotive force with DC voltage does not work well in case of nanopipette having cation-rich double layer due to the inner wall surface charge effect.[2] We developed a method to detect AC signal with a lock-in amplifier by applying both AC and DC voltages.[3] However, the more stable and reproducible detection method is preferred for the application of this method to ion-selective scanning ion conductance microscopy.

In this study, we have developed a method to fabricate ion-selective nanopipette based on a poly(vinyl chloride) (PVC) membrane containing ionophores, *i.e.*, bis(benzo-15-crown-5) or bis(12-crown-4), and the membrane is at the conical shank in the nanopipette, which showed better results compared with our previous method in which the membrane is at the middle of the nanopipette.[3]

Nanopipettes with the inner diameter of 100 nm were prepared with Sutter P-2000. Details of the fabrication of PVC membrane in nanopipette were reported.[3]

The obtained signal was apparently improved, as shown in the right figure. The signal from the previous method (upper figure) was noisy with less reproducibility of the selective detection. On the other hand, the S/N ratio of the signal was improved with this novel method (lower figure) and the reproducibility was also improved.



Upper: Previous geometry of our detection system; the membrane in nanopipette was between water and electrolyte. The obtained signal was noisy and lack of reproducibility. Lower: Our developed detection system; the membrane is at the conical shank in the nanopipette. The obtained signal is less-noise with higher reproducibility.

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