



Biomolecular Nanochannel Sensors Based on Chemically Modified Ion Tracks in Polymer Foils

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Single conical nanochannels are formed by irradiating a polymer foil, such as PET, with a highly energetic ion and etching its damage track into a conical nanochannel with a small tip diameter of several nanometers. The nanochannel walls are chemically modified by attaching biorecognition molecules by appropriate coupling chemistry. The foil with the conditioned nanochannel then acts as a separation membrane between the two compartments of an electrochemical cell. The electrolyte current, consisting of K and Cl ions, is measured. When molecules to be analyzed are present, they specifically interact with the nanochannel walls by bioconjugation and change the ionic current through the nanochannel. Thus, a highly sensitive and selective nanosensor is obtained.

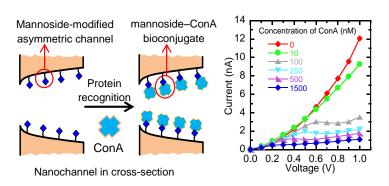


Fig.1 Schematic presentation of function of molecular nanochannel sensor for measuring the protein Concanavalin A (ConA) via mannose (mannoside) coupling.

The electrochemical curve shows that the measured current is a function of the ConA concentration, constituting a highly sensitive nanosensor.

The paper discusses as a survey all aspects of this technology, from the nanochannel preparation up to the principles of the sensor, with the examples of sensing small molecules such as hydrogen peroxide up to biomolecules, such as carbohydrates and peptides. Eventually, the application potential of the sensors for biomedical analysis and clinical diagnostics is discussed.

References

- 1. M. Ali, P. Ramirez, S. Nasir, Q. H. Nguyen, W. Ensinger, S. Mafe, Appl. Phys. Lett. 104, 043703 (2014)
- 2. M. Ali, S. Nasir, P. Ramirez, J. Cervera, S. Mafe, W. Ensinger, J. Phys. Chem. C 117, 18234-18242 (2013)
- 3. S. Nasir, P. Ramirez, M. Ali, I. Ahmed, L. Fruk, S. Mafe, W. Ensinger, J. Chem. Phys. 138, 034709 (2013)
- 4. M. Ali, M. N. Tahir, Z. Siwy, R. Neumann, W. Tremel, W. Ensinger, Analyt. Chem. 83, 1673–1680 (2011)







