SÉMINAIRE DU LABORATOIRE PHENIX

Organic transistor-based chemical sensors for real-sample analysis

Tsuyoshi Minami

Institute of Industrial Science, The University of Tokyo,
4-6-1 Komaba, Meguro-ku, Tokyo, Japan 153-8505
Email: tminami@g.ecc.u-tokyo.ac.jp

9th February 2024, 11 am **32-42 101**

Real samples contain abundant chemical species playing crucial roles in environmental assessments, food analysis, and diagnosis fields. Conventionally, large-sized analytical instruments have been widely applied to real-sample analysis owing to their accuracy. However, the applicability of such a well-established instrumental approach is still a concern in on-site analysis because of the complicated detection principle that requires trained personnel and time-consuming operation. Herein, the presenter introduces an approach for the development of chemical sensor devices based on organic field-effect transistors (OFETs) (Figure 1). OFETs are electronic devices showing switching characteristics by applying voltage. Owing to their beneficial device properties, OFETs functionalized with appropriate molecular recognition materials contribute to sensitive detection over conventional electrochemical sensing methods. Biological materials such as enzymes and antibodies have been employed owing to their favorable specificities to analytes based on the lock-and-key recognition principle. However, detectable analyte structures are limited by a library of these biological materials. Therefore, synthetic receptors based on molecular recognition chemistry are promising approaches in the design of recognition sites. In this study, molecularly imprinted polymers (MIPs) were applied to molecular recognition materials for selective detection. MIPs provide three-dimensional recognition networks against specific analytes because a pre-organized structure made of a template (i.e., analyte) and functional monomers can be optimized by quantum chemical calculation methods. Such optimized MIP structures contribute to selective detection even in the presence of interferents. In contrast, the inherent cross-reactivity of supramolecular receptors can be applied to simultaneous detection by using pattern recognition methods. This presentation will discuss the usability of this approach for the realization of OFET-based chemical sensor devices based on fusion technologies of organic electronics, molecular recognition chemistry, and polymer chemistry.

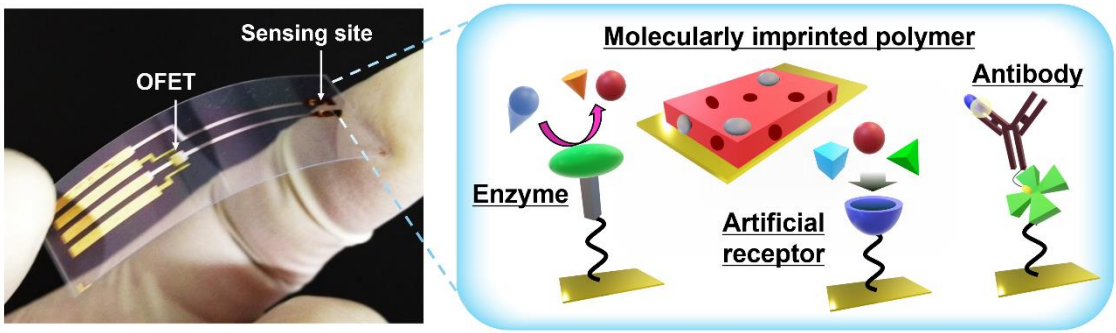

Figure 1. Conceptual figure of an OFET-based chemical sensor functionalized with various molecular recognition materials.