Functional Surface Modified Electrodes as Electro-organic Devices And Their Applications

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In the present plenary lecture, typical achievements for these 35 years related to functional surface modified electrodes and their applications to electro-organic Devices will be presented. The main topics will be: 1) The developments of functional electrodes (including by using the self assembling monolayer, SAM, modification technique, which, at present, is widely used in various fields of surface related science and technology) for the direct rapid electron-transfer of metalloproteins, such as cytochrome c, myoglobin and ferredoxin, and 2) the surface structures of the SAM modified electrodes at the molecular level to understand the surface functions of the electrodes. 3) The applications of such functional modified electrodes to analyze the biological functions of the metalloproteins using electrochemical techniques. 4) Based on the recent developments on direct electron-transfer of enzymes and by using non-enzymatic catalytic electrodes, new sugar (such as glucose and fructose)-air bio-fuel batteries are introduced, as an electro-organic device, at the level of practical use, >10 mA/cm^2 in current and > a few mW/cm^2 in power. In addition, 5) applications of functional modified electrodes are also given to develop electrochemical-sensing devices, including an amperometric gas sensor for blister agent using gold-nanoparticle dispersed carbon-fiber electrodes.

References

[1] I. Taniguchi, K. Toyosawa, H. Yamaguchi, K. Yasukouchi, *J. Chem. Soc., Chem. Commun.,* **1982,** 1032; *J. Electroanal. Chem.,* **1982**, *140*, 187; I. Taniguchi, *Interface*, **1997**, *6*, 34; *Bull. Jpn. Soc. Coord. Chem.*, **2010**, *55*, 19;

[2] T. Sawaguchi, F. Mizutani, I. Taniguchi, *Langmuir*, **1998**, *14*, 3565; *Electrochim. Acta*, **2000**, *45,* 2861; I. Taniguchi, S. Yoshimoto, M. Yoshida, S. Kobayashi, T. Miyawaki, Y. Aono, Y. Sunatsuki, H. Taira, *Electrochim. Acta*, **2000**, *45*, 2843; K. Nishiyama, M. Tsuchiyama, A. Kubo, H. Seriu, S. Miyazaki, S. Yoshimoto, I. Taniguchi, *Phys. Chem. Chem. Phys.*, **2008**, *10*, 6935; Y. Mie, M. Kishita, K. Nishiyama, I. Taniguchi, *J. Electroanal. Chem.,* **2008**, *624*, 305.

[3] T. Akashi, T. Matsumura, T. Ideguchi, K. Iwakiri, T. Kawakatsu, I. Taniguchi, T. Hase, *J. Biol. Chem.,* **1999**, *274*, 29399; Y. Mie, C. Yamada, G. Hareau, S. Neya, T. Uno, N. Funasaki, K. Nishiyama, I. Taniguchi, *Biochemistry*, **2004**, *43*, 13149.

[4] S. Ben Aoun, Z. Dursun, T. Koga, G. S. Bang, T. Sotomura, I. Taniguchi, *J. Electroanal. Chem.*, **2004,** 567, 175; M. Tominaga, C. Shirakihara, I. Taniguchi, *J. Electroanal. Chem.,* **2007,** *610*, 1.

[5] K. Nishiyama, H. Yamada, H. Matsuura, R, Asada, N. Nakano, Y. Seto, I. Taniguchi, *ECS Transactions*, **2008**, *16*, 353; H. Matsuura, H. Yamada, R. Asada, S. Yamaguchi, K. Sato, N. Nakano, K. Nishiyama, I. Taniguchi, Y. Seto, *Sensors and Materials,* **2010**, *22*, 167.