第258回触媒化学研究センター談話会

演　題：Nano-assembled enzyme electrodes for direct glucose fuel cell development

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日　時：2009年7月21日（火）　13:30-15:00

会　場：北海道大学創成科学研究棟　4階セミナー室A（04-215号室）

要　旨： Direct glucose fuel cells are a unique class of electrochemical devices that convert glucose into electricity without fuel reformation. Since glucose is naturally abundant, readily available, non-toxic, and biologically meaningful, direct glucose fuel cells have attracted more and more investigation in the recent years for potential applications in portable electronics, wireless sensors, and blood-powered implants such as a cardiac pacemaker. In principle, direct glucose fuel cells can be achieved with novel metals, enzymes, or microbes that catalyze glucose oxidation at anodes and oxygen reduction at cathodes. In our laboratory, we focus on the development of enzymatic glucose fuel cell systems because enzymatic fuel cells are capable of producing useful electricity (0.01 - 1 mW/cm^2) at room temperature and are well-suited for miniaturization due to enzyme specificity. In the beginning of this lecture, I will briefly introduce a glucose fuel cell prototype based on glucose oxidase (GOx) and laccase (Lac) and show how such a biofuel cell turns glucose and starch into dc electricity to drive low-power (mW-level) electronics. Then, I will present our recent research efforts on the biofuel cell's miniaturization. The fabrication of a flexible, nano-assembled enzyme anode by a proper spatial arrangement of multi-walled carbon nanotubes (MWCNTs), GOx, bovine serum albumin (BSA), and a crosslinkable redox mediator, 2,5-dihydroxybenzaldehyde (DHB) will be described, and the power-output characteristics of the fuel cell based on the nano-assembled bioanode will be discussed. In the end, I will conclude this lecture by addressing the niches of conjugation of nanocatalysts and enzymes for direct glucose fuel cell development. The influences of several nanocatalysts including nanogold (nAu) particles, CNTs, and the nanocatalysts received from Catalysis Research Center at Hokkaido University on the catalytic glucose oxidation will be disclosed and compared.

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