Bio Nano Fuel Cells

Liwei Lin

Co-Director, Berkeley Sensor and Actuator Center Department of Mechanical Engineering University of California Berkeley, California 947201 USA E-mail: <u>lwlin@me.berkeley.edu</u>

Abstract

Continuous and long-term power supply generated directly from biological organisms could have great impact for nano, micro to macro systems. In futuristic applications, for example, diagnosing medical problems and delivering drugs from inside the body has been a dream of doctors since Isaac Asimov's 1966 science fiction classic "Fantastic Voyage," in which a group of doctors were miniaturized and injected into a patient to remove a blood clot. Doctors can't be shrunk, but any future engineering device that resembles the "fantastic voyage" will requires power supply. In large-scale system applications, implantable medical devices such as spinal cord stimulator and drug delivery devices used in spinal drug infusion therapy for pain relief applications also require power. Micro power generation is an important element for small-scale systems and two types of power systems will be discussed in this talk: disposable micro batteries and microbial fuel cells. The motivation of the microbial fuel cells came from the observation of the energy cycle from "nature" energy in the form of light coming from sun assists the photosynthesis process in green plants that convert carbon dioxide and water into glucose. Animals take green plant as the food for glucose support and in the aerobic respiration process, convert glucose and oxygen into carbon dioxide, water and ATP (adenosine triphospate). We propose to extract energy from these energy translation processes by building up artificial fuel cells to interact with living bacteria for engineering applications, such as to power nano or micro devices.

Biography

Professor Liwei Lin received the B.S. degree in Power Mechanical Engineering from

National Tsing-Hua University, Taiwan, in 1986 and M.S. and Ph.D. degrees in Mechanical Engineering from the University of California, Berkeley, in 1991 and 1993 respectively. He joined BEI Electronics Inc. USA from 1993 to 1994 in research and development of microsensors. From 1994 to 1996, he was an Associate Professor in National Taiwan University, Taiwan. From 1996 to 1999, he was an Assistant Professor at the University of Michigan. He joined the University of California at Berkeley in 1999 and is now Chancellor's Professor and Vice Chair in charge of Graduate Study at Mechanical Engineering and Co-Director at Berkeley Sensor and Actuator Center, an NSF/Industry/University research cooperative center. His research interests are in design, modeling and fabrication of microstructures, microsensors microactuators well and as as mechanical issues in microelectromechanical systems including heat transfer, solid/fluid mechanics and dynamics. Dr. Lin is the recipient of the 1998 NSF CAREER Award for research in MEMS Packaging and the 1999 ASME Journal of Heat Transfer best paper award for his work on micro scale bubble formation. He was the Founding Chairman of the Executive Committee of the MEMS division in ASME. He is currently subject editor of IEEE/ASME Journal of Electromechanical Systems, and North America Editor for Sensors & Actuators. He holds 12 U.S. patents in the area of MEMS.