MAR08-2007-020257

Abstract for an Invited Paper
for the MAR08 Meeting of
the American Physical Society

The Integration of Bacteriorhodopsin Proteins with Semiconductor Heterostructure Devices

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Bioelectronics has emerged as one of the most rapidly developing fields among the active frontiers of interdisciplinary research. A major thrust in this field is aimed at the coupling of the technologically-unmatched performance of biological systems, such as neural and sensing functions, with the well developed technology of microelectronics and optoelectronics. To this end we have studied the integration of a suitably engineered protein, *bacteriorhodopsin* (BR), with semiconductor optoelectronic devices and circuits. Successful integration will potentially lead to ultrasensitive sensors with polarization selectivity and built-in preprocessing capabilities that will be useful for high speed tracking, motion and edge detection, biological detection, and artificial vision systems. In this presentation we will summarize our progresses in this area, which include fundamental studies on the transient dynamics of photo-induced charge shift in BR and the coupling mechanism at protein-semiconductor interface for effective immobilizing and selectively integrating light sensitive proteins with microelectronic devices and circuits, and the device engineering of BR-transistor-integrated optical sensors as well as their applications in phototransceiver circuits.

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