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Optical-fiber based localized surface Plasmon resonance biosensors used in optogenetic neural implants

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In most optogenetic neural implants, the light delivery function is accompanied by the ability to detect biological signals from the neural cells, usually through electrical recording using micro-electrodes but sometimes also through optical sensing using biosensors. Varieties of biosensors are optical-fiber-based, such as photonic crystal fiber biosensors and fiber grating biosensors. Thus it is possible to use a single optical fiber for both light delivery and neural signal detection without significantly increasing the complexity of the system. We apply metal nanostructures on the fiber biosensor to take advantage of the ultra-high sensitivity owing to Localized Surface Plasmon Resonance (LSPR). The biosensor we fabricated by removing the cladding from a section of the fiber, assembling gold nanoparticles to it and coating the fiber tip with silver. Broadband light guided to the sensing region interacts with the nanoparticles and is modulated via LSPR and reflected back to a spectrometer by the silver coating. The device was tested and improved to limit the sensing region to ~200 μm scale and the silver coating on the fiber end facet only, on which nanostructures such as nanoaperture arrays also fabricated to further enhance the sensitivity.

Biography

Hongda Chen has received his MSc and PhD degrees from Tianjin University in 1990 and 1996, respectively. He was an Associate Professor at Institute of Semiconductors, Chinese Academy of Sciences (ISCAS) from1997-2001. Since 2001, he has been Full Professor at State Key Laboratory on Integrated Optoelectronics of ISCAS. His main research interests are fundamentals of semiconductor devices, optoelectronic devices and integration technology, very short reach (VSR) module and system, and silicon-based optoelectronic integrated circuits.

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