Optoelectrode

Optical Electrode for Sensing: An optoelectrode could refer to a sensor or electrode system that incorporates optical components for sensing purposes. For example, in biosensing applications, it might involve combining an electrode with optical elements to detect changes in light properties (e.g., absorption or fluorescence) related to specific analytes or biological reactions.

Electrode for Optoelectronic Devices: In the context of optoelectronic devices, an optoelectrode might be an electrode used in conjunction with optical components, such as light-emitting diodes (LEDs) or photodetectors. This combination could be part of a device that involves both electronic and optical functionalities, such as in certain types of sensors or light-emitting devices.

Nanoscale optoelectrodes hold the potential to stimulate optically individual neurons and intracellular organelles, a challenge that demands both a high-density of photoelectron storage and significant charge injection. Here, we report that zinc porphyrin, commonly used in dye-sensitized solar cells, can be self-assembled into nanorods and then coated by TiO2. The J-aggregated zinc porphyrin array enables long-range exciton diffusion and allows for fast electron transfer into TiO2. The formation of TiO2(e-) attracts positive charges around the neuron membrane, contributing to the induction of action potentials. Far-field cranial irradiation of the motor cortex using a 670 nm laser or an 850 nm femtosecond laser can modulate local neuronal firing and trigger motor responses in the hind limb of mice. The pulsed photoelectrical stimulation of neurons in the subthalamic nucleus alleviates parkinsonian symptoms in mice, improving abnormal stepping and enhancing the activity of dopaminergic neurons. Our results suggest injectable nanoscopic optoelectrodes for optical neuromodulation with high efficiency and negligible side effects [1].

1)
Chen J, Liu Y, Chen F, Guo M, Zhou J, Fu P, Zhang X, Wang X, Wang H, Hua W, Chen J, Hu J, Mao Y, Jin D, Bu W. Non-Faradaic optoelectrodes for safe electrical neuromodulation. Nat Commun. 2024 Jan 9;15(1):405. doi: 10.1038/s41467-023-44635-8. PMID: 38195782.