World Academy of Science, Engineering and Technology
International Journal of Biomedical and Biological Engineering
Vol:12, No:11, 2018

Developing Biocompatible Iridium Oxide Electrodes for Bone-Guided Extra-Cochlear Implant

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Abstract : Recently, various bioelectronic devices have been developed for neurologic disease treatments via electro-stimulations such as cochlear implants and retinal prosthesis. Since the electric signal needs electrodes to be transmitted to an organism, electrodes play an important role of stimulations. The materials of stimulation electrodes affect the efficiency of the delivered currents. The higher the efficiency of the electrodes, the lower the threshold current can be used to stimulate the organism which minimizes the potential damages to the adjacent tissues. In this study, we proposed a biocompatible composite electrode composed of high-charge-capacity iridium oxide (IrO_x) film for a bone-guide extra-cochlear implant. IrO_x was exploited to decrease the threshold current due to its high capacitance and low impedance. The IrO_x electrode was fabricated via microelectromechanical systems (MEMS) photolithography and examined with in-vivo tests with guinea pigs. Based on the measured responses of brain waves to sound, the results demonstrated that IrO_x electrodes have a lower threshold current compared with the Platinum (Pt) electrodes. The research results are expected to be beneficial for implantable and biocompatible electrodes for electrical stimulations.

Keywords : cochlear implants, electrode, electrical stimulation, iridium oxide
Conference Title : ICBE 2018 : International Conference on Biomedical Engineering
Conference Location : Kyoto, Japan
Conference Dates : November 15-16, 2018