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STIMULATING NEURAL ELECTRODE - A STUDY ON CHARGE INJECTION PROPERTIES OF IRIIDIUM OXIDE FILMS

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For a stimulating neural electrode, the charge density should be as large as possible to provide adequate stimulation of the nervous system while allowing for miniaturization of the electrode. Since iridium oxide is able to produce high charge densities while preventing undesirable reactions due to charge storage, it has become a promising material for neural prostheses. Successful production of stable Ir and Ir oxide films on various substrates now limits the use of this material.

Ir was deposited on two differently prepared surface of (mirror finish, passivation) surgical Ti-6Al-4V with several methods. Ion beam mixing of sputter deposited Ir films on passivated Ti-6Al-4V produced stable and good adherent Ir films. It was found that the increase in charge density of pure Ir on continuous cycling is due to the accumulation of the oxide phase (associated with a large surface area) in which the valence state of iridium changes and the double-layer capacitance increases. This study also showed that the double layer capacitance is equally or even more responsible for the high charge density of anodically formed Ir oxide.