Surface Modification of Neural Electrode with Electro-deposited Nanoparticle for Stimulation Performance Enhancement

Yong Hee Kim and Sang-Don Jung

Electronics & Telecommunications Research Institute (ETRI)
Daejeon 305-700, South Korea
E-mail address: josephinkim@etri.re.kr, jungpol@etri.re.kr

Efficient charge injection without causing damage to neural tissues has been one of the key issues in many *in vitro* and *in vivo* neural interfacing applications, such as neuromodulation, brain-computer interface, and neuroprothetics. To achieve this, much effort had been devoted to modification of neural electrode with metallic nanostructures such as nanoparticles (NPs), nanowires, nanorods, nanopores, and nanopillars.

Recently, we have modified the gold (Au) electrode with Au NPs, platinum (Pt) NPs, Au-Pt NPs, iridium oxide (IrOx) NPs, and nanoporous gold (NPG) structure by electrodeposition method. All the NP-modified Au electrode exhibited poor charge injection limit (<0.1 mC cm^{-2}) except NPG-modified electrode. The NPG-modified electrode exhibited charge injection limit close to safety limit of 1 mC cm^{-2}. To improve the marginal charge injection limit of NPG-modified electrode, we have electrodeposited IrOx NPs on the NPG-modified electrode and achieved the charge injection limit of 2.3 mC cm^{-2}. We have also achieved charge injection limit of 0.53 mC cm^{-2} from IrOx/Au-Pt NP-modified electrode and 1.9 mC cm^{-2} from IrOx/ITO NW-modified ITO electrode.

In this meeting, we introduce our recent progresses in enhancement of charge injection performance of the neural electrode based on electrodeposition of metallic NPs.