Micro/Nanoscale Approaches for Connecting Electronics to the Brain

Takeshi Kawano

Institute for Research on Next-generation Semiconductor and Sensing Science (IRES2), Department of Electrical and Electronic Information Engineering, Toyohashi University of Technology
kawano@ee.tut.ac.jp

Abstract

Microscale needle-electrode devices have been used for recording high spatiotemporal neuronal signals within brain tissue. However, the electrode geometry should be miniaturized to a diameter of less than 10 μm in order to reduce tissue damage. This presentation introduces a silicon growth technology capable of achieving needle-electrode arrays with a 5-μm diameter. Our electrode device demonstrated the ability to provide chronic recording in the brain of a mouse for a period of 6 months. Furthermore, this presentation addresses a device assembly technique that involves stacking an amplifier module on the electrode. This device technique enables us to further miniaturize the needle-electrode diameter to less than 1 μm, providing damage-reduced neural recording and enhancing its suitability for chronic applications.