Enabling Technologies for Biomedical Device Fabrication

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Abstract

Two enabling technologies for production of implantable biomedical electronics, laser cutting and thin film deposition were investigated. These enabling technologies are important for complex devices such as the bionic eye.

The first enabling technology was laser cutting. Although laser cutting as a method to produce micro electrodes in a range of biomedical applications is not new there is a lack of comprehensive measurements, especially comparing the use of nanosecond and femtosecond lasers. Both lasers were used to cut grooves into Ni-Ti and Pt to test their use in producing high density micro electrode arrays. Various grooves depths were produced using multiple laser passes. The nanosecond laser was found to have a significant higher cutting efficiency than the femtosecond laser. It was also found that the melt produced by the nanosecond laser had a significant impact on the groove geometry. The work presented here shows that nanosecond lasers are preferred for rapid production of shallow groves but femtosecond laser cutting is preferred for deep groove cutting.

Feedthroughs in the walls of implanted biomedical devices are required to carry electrical signals to the device. Biocompatible materials such as alumina and platinum must be used for the wall and feedthrough respectively and the feedthrough must be sealed hermetically. According to the literature these two materials only bond if heat and contact pressure is used. Because of the delicate nature of the device, four methods to bond alumina to platinum substrates were trialled without using contact pressure. All methods produced alumina films that adhered well to the platinum substrate. The best film was found to be produced by atomic layer deposition. Therefore this encapsulation method would enable the fabrication of feedthroughs between platinum electrodes and alumina insulation.