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**< 250 words abstract**

This paper summarizes the results of an EU project called ACTION: ACTive Implant for Optoacoustic Natural sound enhancement. The project is based on a recent discovery that relatively low levels of pulsed infrared laser light are capable of triggering activity in hair cells of the partially hearing (hearing impaired) cochlea and vestibule. The aim here is the development of a self-contained, smart, highly miniaturized system to provide optoacoustic stimuli directly from an array of miniature light sources in the cochlea. Optoacoustic compound action potentials (oaCAPs) are generated by the light source fully inserted into the unmodified cochlea. Previously, the same could only be achieved with external light sources connected to a fiber optic light guide or with optogenetically modified cells. This feat is achieved by integrating custom made VCSEL arrays at a wavelength of about 1550 nm onto small flexible substrates. The laser light is collimated by a specially designed silicon-based ultra-thin lens (165 um thick) to get the energy density required for the generation of oaCAP signals. A dramatic miniaturization of the packaging technology is also required. A long term biocompatible and hermetic sapphire housing with a size of less than a 1 cubic millimeter and miniature Pt/PtIr feedthroughs is developed, using a low temperature laser assisted process for sealing. A biofouling thin film protection layer is developed to avoid fibrinogen and cell growth on the system. Long term hermeticity is proven by He and dedicated FTIR leak testing methods.

**< 100 words abstract**

This paper summarizes results based on a recent discovery that relatively low levels of pulsed infrared laser light are capable of triggering activity in hair cells of the partially hearing cochlea and vestibule. Optoacoustic compound action potentials (oaCAPs) are generated by a light source fully inserted into the unmodified cochlea. The light source is a VCSEL array packaged along with a silicon-based ultra-thin lens into a miniature housing. A dedicated sealing process for this long term biocompatible and hermetic sapphire housing with a size of less than a 1 cubic millimeter and Pt/PtIr feedthrough technology is developed.