

**Offer for Coursework / Diploma / Master Thesis**

Topic: Electrode Design for Flexible Optical Cochlear Implants Based on an Array of Organic LEDs

Objective of the thesis:

Optical cochlear implants are an emerging approach for spatially selective stimulation of auditory neurons through optogenetic stimulation. Compared to conventional electrical cochlear implants, optical stimulation may offer strongly improved spatial resolution and, thus, significantly improved hearing function. While concepts using micro-LED-based optical cochlear implants have already been demonstrated, the devices are inherently rigid and possess only limited spatial resolution. Here, organic light-emitting diodes (OLEDs) shall be explored, which offer an alternative route toward thin, flexible, and conformable optical stimulation devices.

In this master's thesis, patterned bottom electrodes will be developed for flexible top-emitting OLED arrays intended as optical cochlear implant. The work will focus on the design, fabrication, and characterisation of patterned metallic electrodes on flexible substrates, followed by integration with OLED stacks. Particular attention will be given to electrode conductivity, channel isolation, mechanical flexibility, contact reliability, and compatibility with OLED deposition. The final demonstrator should allow individual addressing of OLED pixels and pulsed optical operation under implant-relevant conditions

Within the framework of this thesis, the following subtasks are to be worked on:

- Literature review on optical cochlear implants, OLED-based optogenetic stimulation devices, and patterned electrode architectures.
- Design of a layout for patterned OLED electrodes and multi-channel demonstrator geometries in CAD.
- Fabrication of patterned metallic bottom electrodes through photolithography and characterization of their electrical properties such as sheet resistance and electrical isolation between neighbouring channels, also on flexible substrates.
- Mechanical characterization of the patterned electrodes, including bending tests, adhesion evaluation, and assessment of electrode stability before and after mechanical deformation.

Suitable for students of all electrical engineering degree programs.

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