

Master Thesis: CC-SiNOH Modulators

For electrooptic conversion, efficient and broadband modulators are needed. Silicon organic hybrid (SOH) modulators offer efficient electrooptic modulation due to their very low π -voltage-length product [1]. However, their bandwidth is limited by the resistive coupling between the metal electrodes of the microwave line and the optical slot-waveguide. By using capacitive coupling (CC), the bandwidth limitation can be overcome [2]. Thereby, modulators with a low π -voltage and a large bandwidth can be built. Other important features are optical losses and power handling capability, which both are limited on the silicon platform. This thesis aims for a CC modulator, that is integrated on the silicon nitride (Si_3N_4) platform, featuring a low insertion loss and high power handling capability.

Your tasks:

- Transferring the concept of CC-SOH modulators on the silicon nitride platform
- Electrical and optical simulation
- Improving the design of CC-SiNOH modulators
- Fabrication and characterization of new devices

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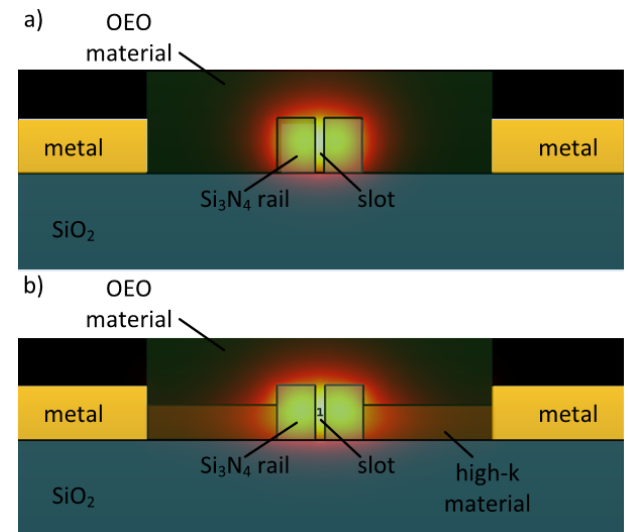


Fig. 1: CC-SiNOH modulator a) without and b) with high-k material between the metal electrodes and the slot-waveguide

- [1] Kieninger *et al.*, "Ultra-high electro-optic activity demonstrated in a silicon-organic hybrid modulator," *Optica*, vol. 5, no. 6, pp. 739-748, 2018, doi: <https://doi.org/10.1364/OPTICA.5.000739>
- [2] Ummethala *et al.*, "Capacitively Coupled Silicon-Organic Hybrid Modulator for 200 Gbit/s PAM-4 Signaling," in *CLEO*, San Jose (CA), USA, May 5-10, paper JTh5B.2 Optical Society of America (2019), doi: https://doi.org/10.1364/CLEO_AT.2019.JTh5B.2 (postdeadline).