



## Our profile

AMO GmbH, a non-profit high-tech-SME with close to 40 employees, runs a 200 mm pilot line and specializes in R&D for micro/nano electronics and photonics. AMO operates 400 m<sup>2</sup> cleanroom equipped with an electron beam lithography and i-line projection lithography system for definition of nanostructures supported by a large selection of tools for thin film deposition, reactive ion etching and metrology. Currently the main research activities are focused on development of integrated laser sources for silicon photonics, optoelectronic devices based on 2D materials (graphene, transition metal dichalcogenides) and plasmonic bio sensors.

## Master thesis topic

Development of fabrication processes for integrated perovskite micro optoelectronic devices.

## Supervised by

Univ.-Prof. Dr.-Ing. Max Christian Lemme,  
Lehrstuhl für Elektronische Bauelemente,  
Fakultät für Elektrotechnik und Informationstechnik

## Overview

Since 2016 the nanophononics group at AMO GmbH is working on the development of monolithically integrated lasers for silicon nanophotonic circuits. In 2017 we have demonstrated the first metal-halide perovskite laser integrated on silicon nitride photonics<sup>1</sup> using optical pumping. Such lasers are a very interesting alternative to typical III-V lasing materials, which cannot be monolithically integrated on silicon substrates. Based on this preliminary work we are aiming at developing a low cost electrically pumped laser, which will have a substantial industrial impact.

Metal-halide perovskites are solution processed semiconductors which recently drew a lot of attention for optoelectronic devices<sup>2-4</sup>. Their patterning, however, is extremely challenging. Currently we are the only research group in the world which can pattern perovskites using common optical lithography. **Your job will be to help push our technology further by developing processes for fabrication of electrical contacts to perovskites, which is a major step towards electrically pumped lasers.**

**Contact:**

Piotr Cegielski, M. Sc. Eng.  
Nanophotonics Group

**AMO GmbH**

Otto-Blumenthal-Straße 25  
52074 Aachen

[cegielski@amo.de](mailto:cegielski@amo.de)

+49 (0) 241 - 8867 126

**Your profile:**

- Master student of electrical engineering, physics, material science or similar
- Strong interest in nanotechnology fabrication in our clean room and experimental work
- Background in microelectronics or/and laser physics is a plus
- You can communicate fluently in English

**Your tasks:**

- Development of fabrication processes for optoelectronic perovskite devices: lithography, etching and thin film deposition
- Structural, optical and electrical characterization of micro structures and devices

**References:**

1. Cegielski PJ, Neutzner S, Porschatis C, et al. Integrated perovskite lasers on a silicon nitride waveguide platform by cost-effective high throughput fabrication. *Opt Express*. 2017;25(12):13199. doi:10.1364/OE.25.013199
2. Zhang N, Sun W, Rodrigues SP, et al. Highly reproducible organometallic halide perovskite microdevices based on top-down lithography. *Adv Mater*. 2017;29(15):1606205. doi:10.1002/adma.201606205
3. Wang H, Haroldson R, Balachandran B, et al. Nanoimprinted Perovskite Nanograting Photodetector with Improved Efficiency. *ACS Nano*. 2016;10(12):10921-10928. doi:10.1021/acsnano.6b05535
4. Zhu H, Fu Y, Meng F, et al. Lead halide perovskite nanowire lasers with low lasing thresholds and high quality factors. *Nat Mater*. 2015;14(6):636-642. doi:10.1038/nmat4271