ETH zürich

Semester Project

Millimeter Wave Electronics Laboratory, D-ITET
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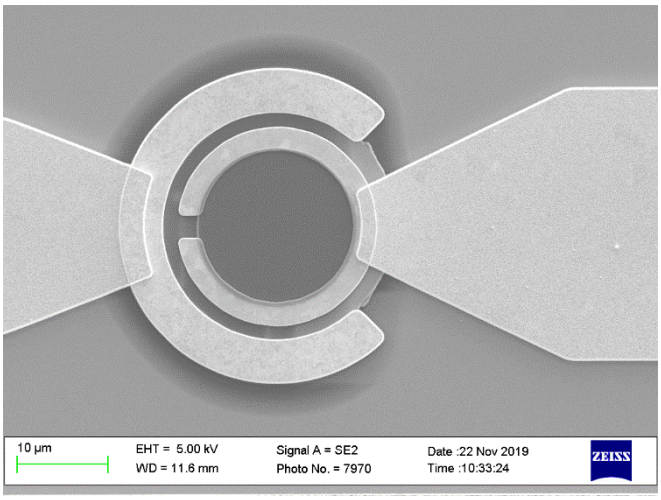
Design of Anti-Reflection Coating for III-V Photodiodes

Vision

Photodiodes (PDs) play a crucial role in the field of optical communication and high-speed data transmission for optical to electrical signal conversion. To obtain the maximum efficiency, the incident light needs to be coupled efficiently on to the device. Anti-reflection coating (ARC) are used to reduce the reflection of incident light from the top of the semiconductor surface.

Anti-reflection coating consists of thin layer of dielectric material, with a specially chosen thickness so that interference effects in the coating cause the wave reflected from anti-reflection coating top surface to be out of phase with wave reflected from the semiconductor surface. It relies on two criteria: the refractive index and film thickness of the material. Multiple stack of dielectric materials can be used to achieve minimum reflection.



SEM image of an InP based photodiode fabricated in the MWE-lab.

Thesis Description

The goal of this project is to use MATLAB to simulate multi-layer ARC on top of InP based photodiodes, find the optimized dielectric stack for minimum reflection and later verify the results experimentally using the cleanroom facility at ETH. This project requires understanding the underlying physics of thin films and MATLAB programing.

You will

- Gain insight into the photodiode device structure, and possibly the fabrication process flow.
- Investigate the influence of multilayer dielectric stack on the light absorption in photodiodes.
- Suggest an optimized multilayer dielectric stack for minimum reflection.
- Gain cleanroom experience and experimentally verify the simulated results for optimized ARC stack.

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