

Fabrication of high aspect ratio Through-Silicon Vias.

Semester project

General Information

Laboratory: Advanced Quantum Architecture Laboratory (AQUA)

Partners: EPFL

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Location: CMI at EPFL

Starting date: ASAP

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Motivation

Through-Silicon Vias are a key technology for 3D stack of multiple CMOS and non-CMOS chips. The use of this technology allows the implementation of multi wafer stacks.

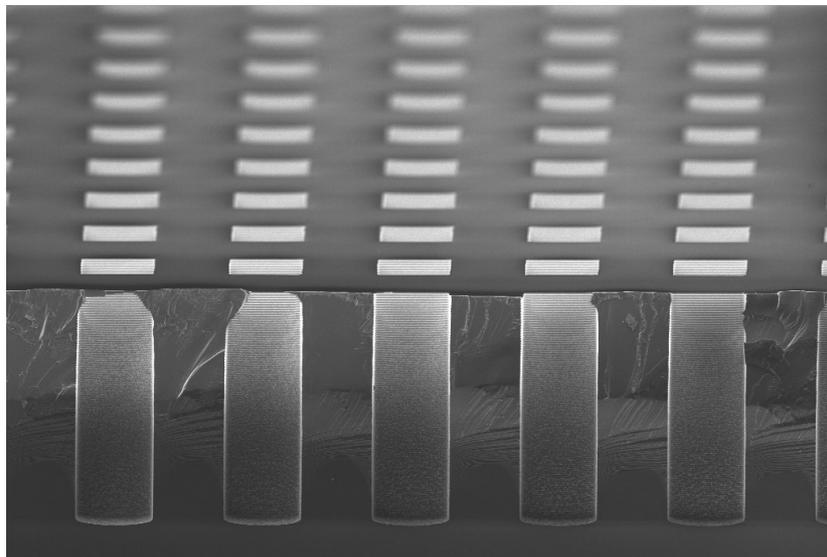


Figure 1: Cross-sectional SEM of ready-to-fill TSV

Project Description

The project is going to focus on the fabrication of high aspect ratio Through-Silicon Vias. The project will consist in three main phases.

1. **Preparation** [first month]. In the first phase, the student will design the mask for the photolithography of the TSVs and will get all the trainings required by the CMI staff in order to be independent in the fabrication process. During this phase the student will learn how to design *.gds* files in an automatic way using the python library *gdsCAD*. Then, the student will help fabricate the photolithography mask she will use for the TSV design.
2. **Analysis** [core of the project]. In the second phase, the student will learn how to fabricate the TSVs following two different process flows, and will show and analyze, by means of SEM images, the TSV quality difference and will extrapolate guidelines for the design process. During the fabrication, the student will sweep some parameters to assess their influence in the fabrication process:
 - a. Materials used for the seed and adhesion layers deposition.
 - b. TSV quality dependence with respect to the aspect ratio.
 - c. TSV pitch, to assess if there is any proximity effect playing a role in the fab process and at what point it becomes relevant.
3. **Optimization** [last month]. In the third and final phase, the student will, with the acquired knowledge from phase two, design and fabricate a wafer with the highest aspect ratio he/she expects to get.

Tasks

- Literature search
- Fabrication of TSVs (Photolithography, DRIE etching and ALD among the other)
- Analysis of the fabricated devices by means of SEM