GMP SA
Av. des Baumettes 17
CH-1020 Renens

Tél. 021 633 21 21
Fax 021 633 21 29
info@gmp.ch – www.gmp.ch

GMP
GENERAL
MICROTECHNOLOGY
& PHOTONICS

SYSTEMS FOR INDUSTRY
RESEARCH
TELECOM & MEDICINE

1st prize: Dr. Martin Pfeiffer for his thesis work at EPFL under the direction of Prof. Tobias Kippenberg.

Subject: manufacturing process of high performance optical on-chip waveguides.

The first prize went to Martin Pfeiffer for his thesis work in the field of integrated photonic circuit technology at EPFL under the supervision of Prof. Dr. Tobias Kippenberg.

To appreciate the impact of his work, we must make a small historical excursion: To continue the progress in the miniaturization of integrated circuits (IC) in 1990, it was necessary to replace the tracks of aluminum conductors with brass. However, the methods of structuring copper were not compatible with the methods of manufacturing ICs in a clean room. IBM then developed an additive technique (the "Damascene" process) that roughly consisted of depositing an insulating layer on the silicon, digging channels in this layer by dry etching, and removing the copper layer by mechanical/chemical polishing.

With the fabrication of integrated photonic circuits on silicon, the situation was comparable in 2010: the miniaturization of waveguides for light on silicon wafers was limited by enormous optical losses in the guides made from thin layers structures on silicon. They have been made by restructuring the thin waveguide layer applied (example Silicon Nitride Si3N4).

When Martin Pfeiffer started his thesis work in 2013 there was no solution. He was inspired by the history of the IC manufacturing and thus developed and patented a procedure "Damascene for photonics". His first publication on this technique in 2016 was an exceptional breakthrough in this discipline: It had a huge impact and was cited more than 100 times in less than two years.

In the work following his thesis, he refined the fabrication and use of silicon photonic circuits by studying the mechanical and optical properties and by characterizing the performance of optical circuits by simulation and experiments. The reproducibility of its waveguide manufacturing technology has allowed it to manufacture various integrated optics circuits that have been used in several collaborations and has contributed to the success of the experiments.

In the last three years of his thesis more than 25 papers have been published in various optical disciplines such as OCT (optical coherence tomography), ultra-fast distance measurement, telecommunication consistent with flow rate in the range of terabits/s, the synthesis of high precision optical frequencies and the generation of solitons.