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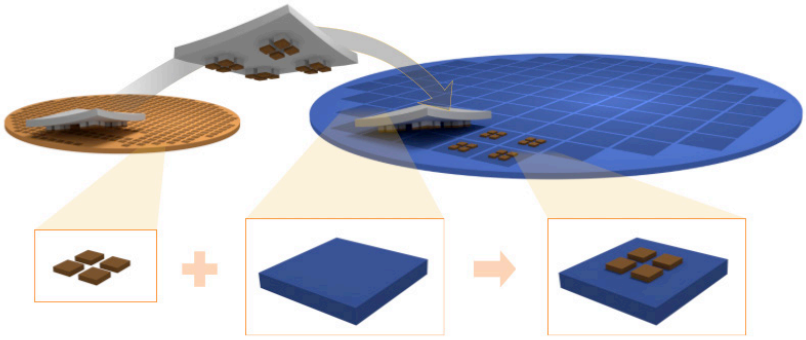
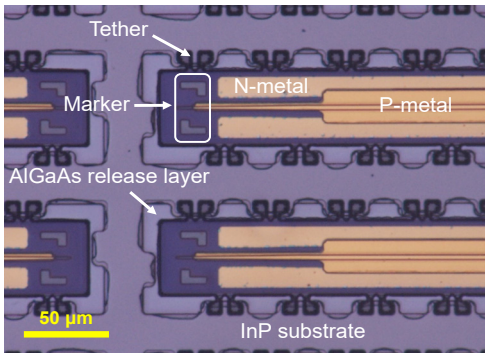
Micro-transfer printing for heterogeneously integrated photonic integrated circuits

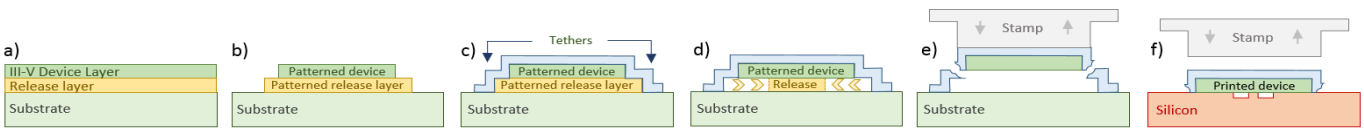
Micro-transfer printing is a technique for heterogeneous integration of different materials, such as III-V materials on silicon. The III-V device and silicon/SiN semiconductor circuit are first processed separately, after which the III-V device is transferred to the target circuit. It can be done both on an individual chip as on a full wafer, transferring all the III-V devices in one step.



Wafer-level pick-and-place to transfer many III-V devices in one step



Semiconductor optical amplifiers (SOAs) on III-V coupons ready to be transfered



III-V devices are patterned seperately, after which they are detached from their original substrate by removing the release layer. They are picked up using a stamp and transferred to a patterned Si/SiN chip or wafer

Back-end of line integration

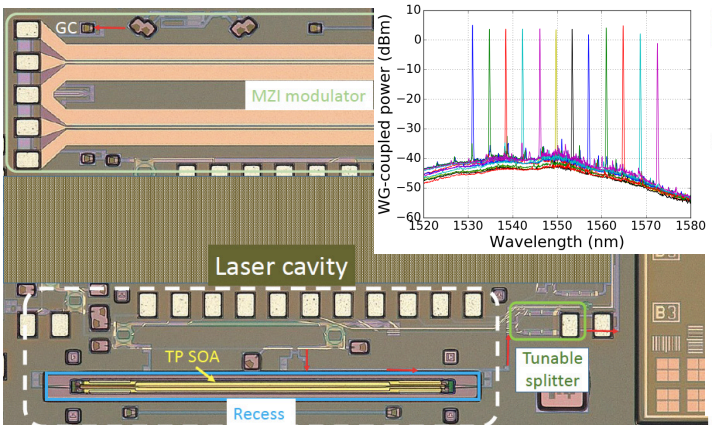
- Patterning the III-V device, or any other material, is done separately from the patterning of the Si/SiN
- Eliminates contamination issues in fab
- Demonstrated integration of Si, InP, GaAs, GaSb and LiNbO3 devices on SOI and SiN platforms

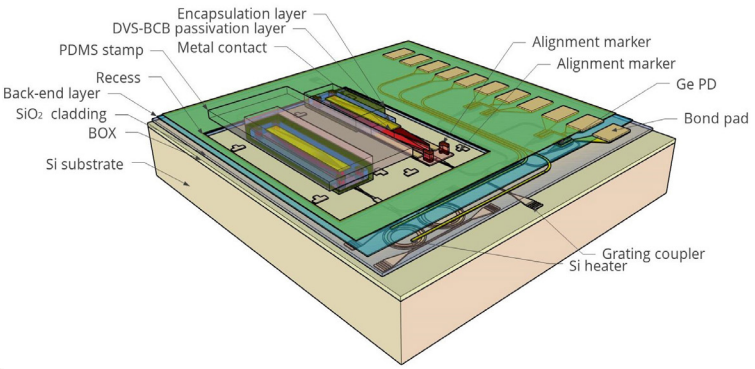
High yield potential

- Devices can typically be tested before being transferred
- 45 sec print cycle populating an entire reticle with a single device type

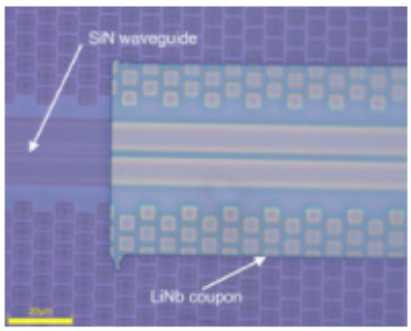
Advantages of micro transfer printing for heterogeneous integration

- No lattice match required
- Highly efficient use of source material

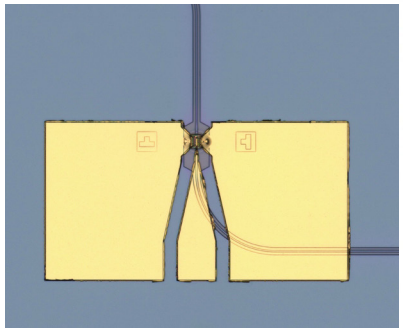




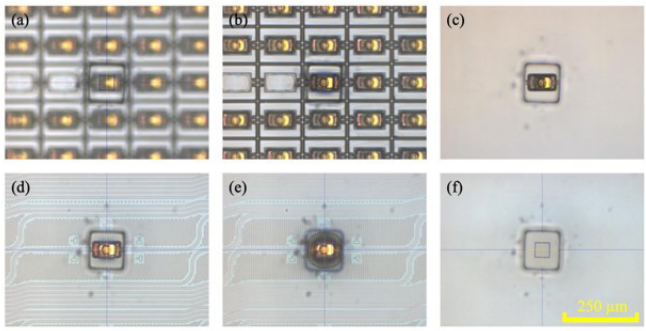
2D and 3D schematics of an integrated tunable laser using III-V SOA transfer printed on silicon



$LiNbO_3$ coupon transfer printed on top of a SiN waveguide circuit



I II-V UTC photodiode (> 100GHz bandwidth) transfer printed on top of a SiN waveguide circuit



Micro-transfer printing 850nm GaAs VCSELs on a SiN waveguide circuit

Transfer printing solutions tailored to your needs

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