



43. Chemnitzer Seminar One Health

Biosensor Integration –
How to Get Your Sensors to Work!

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Who needs microfluidics?



Who needs microfluidics?



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Microfluidics

On the road to biosensor integration



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On the road to biosensor integration



Routes for biosensor integration

What to consider for Biosensor Integration?

Biosensor

- Interfaces (optical, electrical, mech.)
- Chem./thermal/mech. stability
- Environmental conditions

Assay

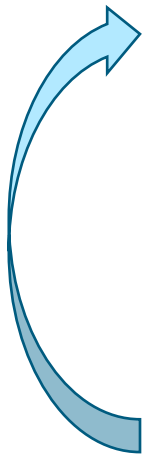
- Reagents
- Volumes
- Processing steps (mixing, heating, filtration,...)
- Spec./non-spec. binding

Use case

- Environmental conditions
- Available infrastructure
- User requirements (trained/untrained)
- Number of chips
- Cost

Material

- chemical resistance (solvents, strong acids/bases)
- transparency
- Temperature
- gas permeation
- (mech. stability)



Strategies for Biosensor Integration

Re-create the lab process

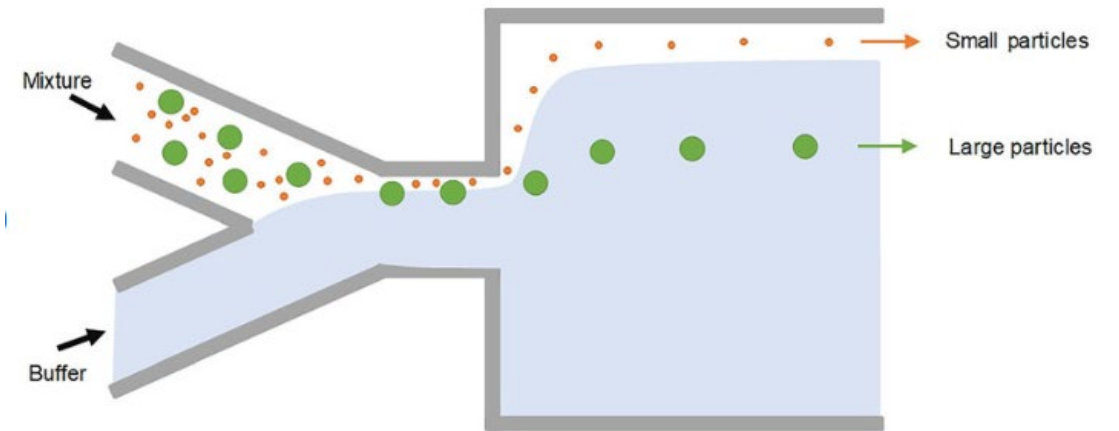
- Analyse the lab process
- Find microfluidic representatives
 - Pipetting = pumping
 - Shaking = mixing structure
 - Heating = heating
 - ...
- Build up microfluidic network out of OTS components



Strategies for Biosensor Integration

Re-think the assay

- Analyse the whole assay/biosensor
- What are the underlying (bio) chemical or physical mechanisms?
- What are microfluidic effects to achieve these goals?
- Choose the right technology
- Go for an integrated chip



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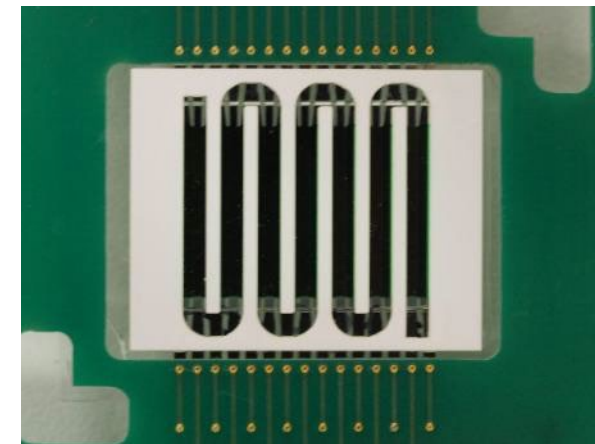
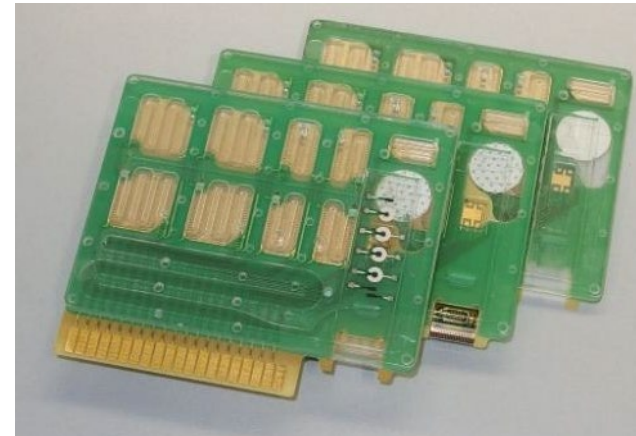


Technologies

Technologies for Biosensor Integration

Adhesive films

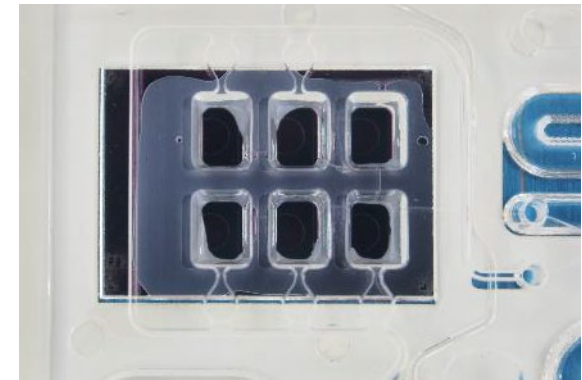
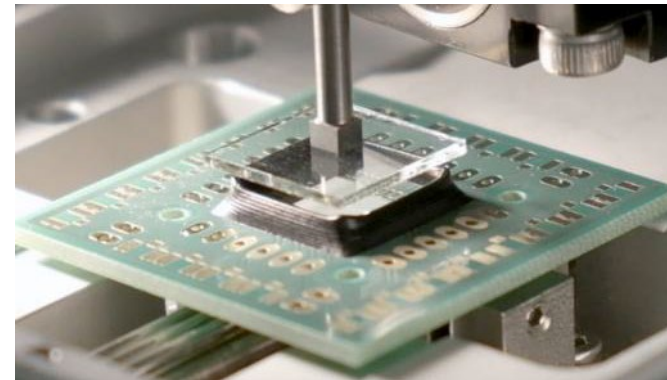
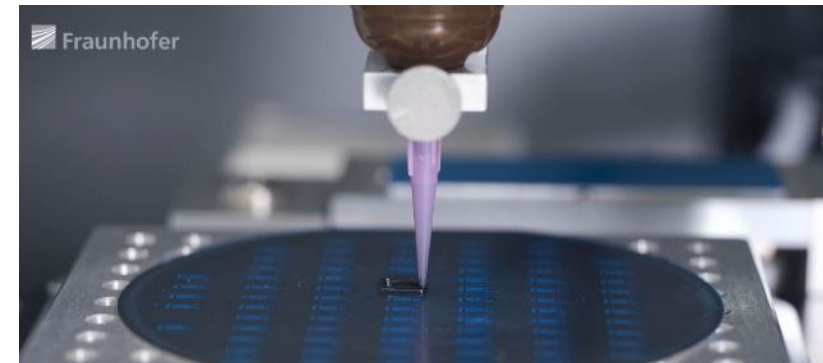
- Use of precut double sided adhesive films
- Important:
check/test compatibility with your assay
- Simple desktop cutters are sufficient for most applications
- Smaller feature by laser micromachining
- Film may form microfluidic channels
- Low temperature → important for existing biofunctionalization



Technologies for Biosensor Integration

Liquid glue

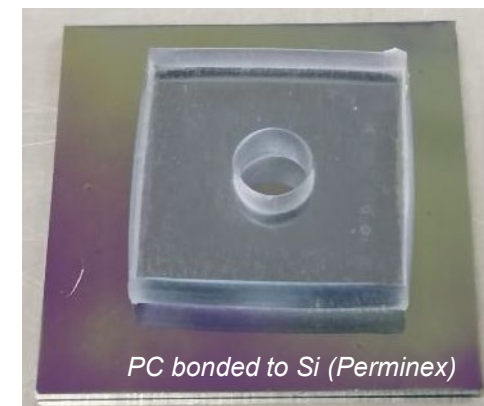
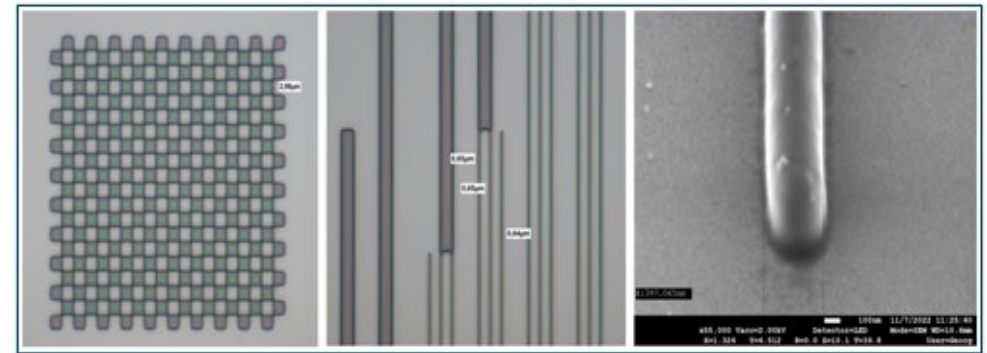
- Dispensing of liquid glues such as silicone and 1K/2K-Epoxy
- Important:
check/test compatibility with your assay
- Precise dispensing and chip handling setup necessary
- Restrictions in conjunction with small channel
- Low temperature possible



Technologies for Biosensor Integration

Diffusion bonding (e.g. Perminex)

- Bonding without intermediate layers by application of pressure and temperature
- Perminex is a negative tone resist suitable for ultra low temperature bonding ($\sim 80^{\circ}\text{C}$)
- Negative resist may form complex microfluidic features
- Permanent heterogeneous bonds between glass, Si, Polymers,...
- PCR compatible



On the road to biosensor integration



Future challenges

What are the future Challenges?

Sample preparation



<https://www.prevention.com/food-nutrition/healthy-eating/g23065278/high-protein-foods/>

Sustainability



<https://www.stuttgarter-nachrichten.de/inhalt.stuttgart-die-pandemie-und-der-abfall-veraendertes-muellaufkommen-durch-corona>

New methods



<https://www.krisp.org.za/toys.php?id=14>

Cost

On the road to biosensor integration



Summary

Biosensor integration

- Have clarity about biosensor AND bioassay requirements
- Analyze the use case
- **check/test material compatibility**
- Choose and integration approach and technology (and the corresponding partners)
- Microfluidics is your friend!



Thank you for your attention!

Contact

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