



PhotonHub Experience Centre

Course

Integrated polymer photonic systems

Course Provider

VTT-Technical Research Centre of Finland

Course Overview

Integrated (embedded) polymer photonics systems are key building blocks in many disruptive product innovations like multidisciplinary environment and diagnostic sensors, displays, energy sources and wearable devices.

This 3-day training course provides overview on the realization of functional systems using non-conventional fabrication technologies based on polymer-based materials and their printing- and hybrid integration.

Hands-on training includes the participation in the real production runs comprising component fabrication by nanoimprinting, non-photonic microfluidics and flexible electronics board fabrication, hybrid integration of Si/compound semiconductor components on flexible/stretchable carriers and post-processing by roll-to-roll injection moulding. During test runs, functional components and systems are realized.

Infrastructure



Automotive



Health tech



Target Audience

The intended audience comprises industrial concept developers, designers, manufacture engineers and test engineers. The course covers the key material related topics, component production and hybrid integration.

Expected Outcomes

- 1) Perform printing/replication processes to fabricate optical, electrical and microfluidic features
- 2) Perform hybrid integration of Si/compound rigid components on flexible and stretchable carriers
- 3) Perform post-processing by injection molding to produce embedded photonic systemsPerform
- 4) Learn about critical polymer photonic component fabrication and integration design rules
- 5) Learn how to manage the polymer photonic product design and fabrication processes

3D Virtual tour



How embedded photonic systems can be produced - Virtual Tours at VTT

Please take a look at the videos down below and check out the virtual tour to visit our premises in Oulu, Finland. Do note, the videos are made with 360° technology, so you can rotate and zoom the views to also see some more detailed embedded videos from different parts of the processes. This tour consists of 6 different locations:

Roll-to Roll Printing <https://youtu.be/gir5jxJqGk0>

Roll-to-Roll Assembly <https://youtu.be/YJ3vBuZ6xIQ>

Roll-to-Roll Converting <https://youtu.be/vMDoou1mLv8>

Roll-to-Roll micro and nano-structuring for silicone elastomers <https://youtu.be/l5c39wb3YxQ>

Roll-to-Roll Testing https://youtu.be/6U9_7ZEop0M

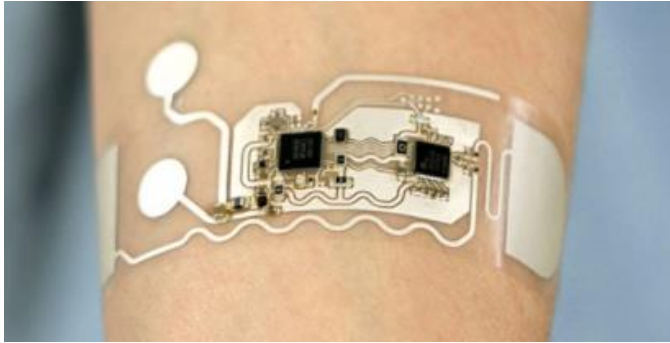
Roll-fed Injection moulding <https://youtu.be/Zf5r09v3HnA>

Course Schedule

Day & Time	Training Activity
Day 1 (09:00 – 12:00)	Introduction to integrated polymeric photonic systems and their applications. (lectures)
Day 1 (14:00 – 17:00)	Component fabrication by printing/imprinting (hands-on)
Day 2 (09:00 – 12:00)	Hybrid integration of Si/compound semiconductor components on rigid, flexible and stretchable polymer carriers (hands on) (hands-on)
Day 2 (14:00 – 17:00)	Lamination (monolithic integration) of optics and microfluidics for disposable opto-fluidic biosensors (hands-on)
Day 3 (09:00 – 12:00)	Post-processing, in-moulding and embedding of photonic systems inside plastics: example on automotive and wearable (hands-on)
Day 3 (14:00 – 17:00)	Testing, reliability under mechanical and environmental stress (hands-on)

Day 1

Morning: Introduction to integrated polymeric photonic systems and their applications.



Wearable ECG skin patch



Portable home diagnostic device

Afternoon: Component fabrication by printing/imprinting (Active and passive component, Hands-on)



MAXI printing line



ROKO – in-air roll-to-roll pilot line

Day 2

Morning: Hybrid integration of Si/compound semiconductor components on rigid, flexible and stretchable polymer carriers (hands on)



EVO assembly machine

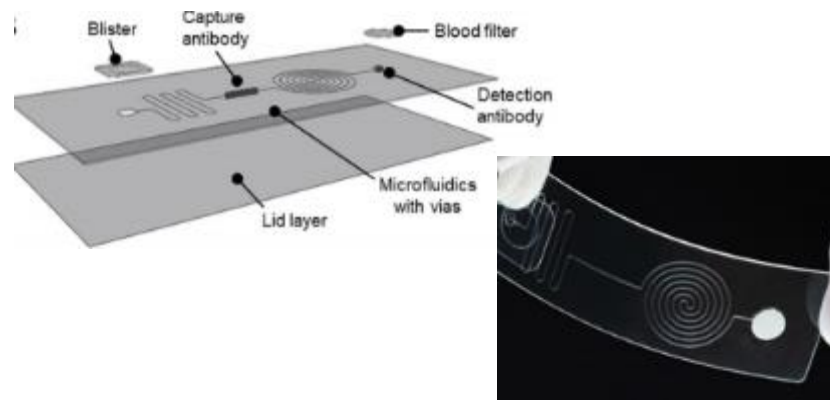


LAKO assembly line

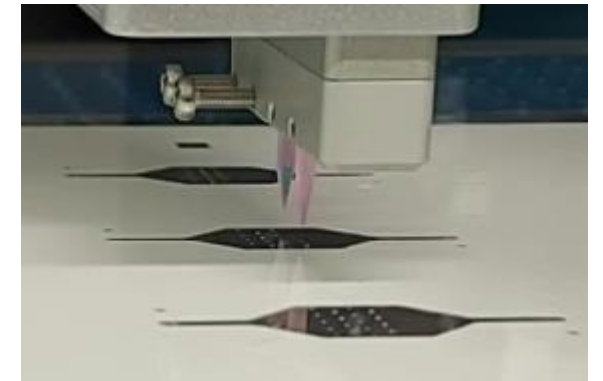
Afternoon: Lamination (monolithic integration) of optics and microfluidics for disposable opto-fluidic biosensors (hands on)



DELTA converting line



Integrated microfluidic device



Biosensors

Day 3

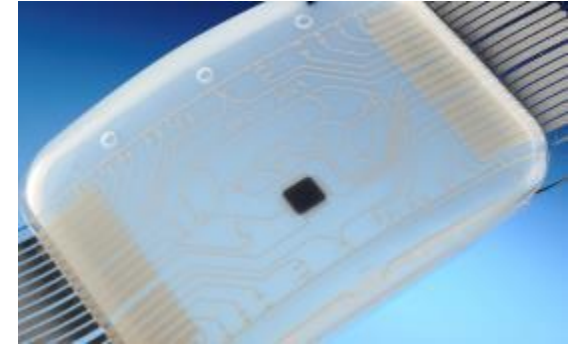
Morning: Post-processing, in-moulding and embedding of photonic systems inside plastics: example on automotive and wearable



ENGEL injection moulding machine



Embedded LED foils



Inmould structural electronics

Afternoon: testing, reliability under mechanical and environmental stress



TESLA2 testing machine



Tension / Compression test stand



Environmental chambers

Course Material (technical hand-outs)

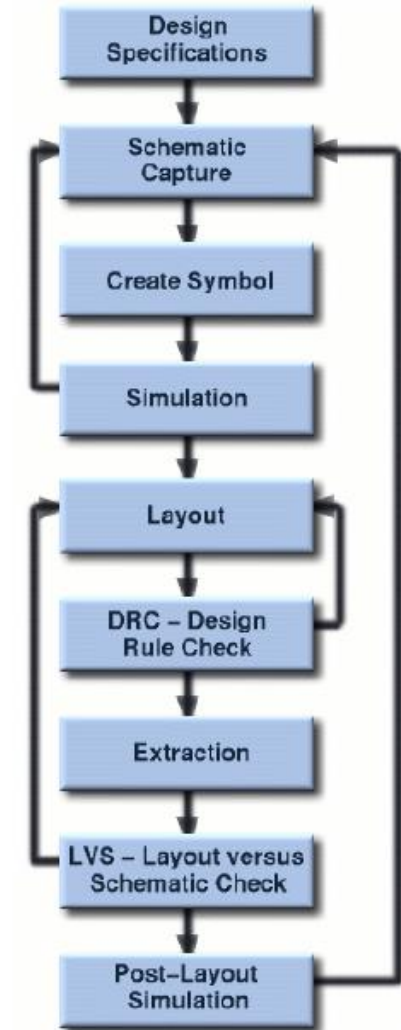


Figure 1. Printed -hybrid Design Flow

Photonics edition from Printed Intelligence handbook (266 pages).

Course Location, Schedule & Cost



- Course Schedule (January, July, December – exact dates to be confirmed)
- Number of people (Groups of 20 people per course)
- Course Cost (500 Euros per person, includes catering and project consumables)

Further Information

- markus.tuomikoski@vtt.fi
- <https://www.youtube.com/watch?v=sh62l9fFXgl>
- <https://www.printocent.net/>

Keywords

Polymer photonics, printed electronics, hybrid integration, microfluidics, integrated system, wearables, biosensors, displays, illumination

Relevant Technology & Application Domain

Technology: polymer photonics, printed electronics, embedded photonics systems

Application: Automotive, infrastructure, health tech