Biodegradable electronics – a contribution to the Green Deal objectives

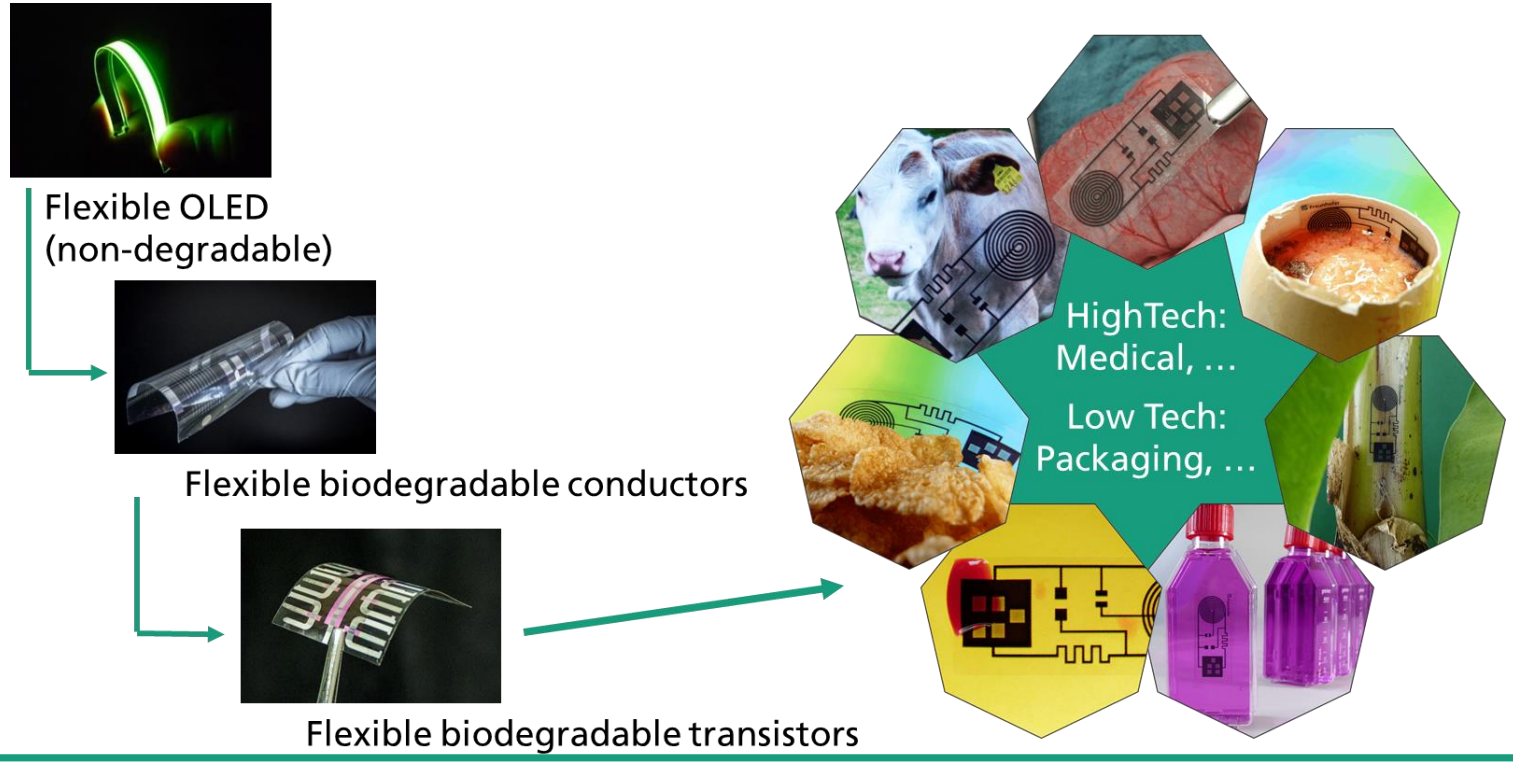
WIR SIND EIN AUSGEZEICHNETER ORT 2018

Ausgezeichnete Orte im Land der Ideen

Nationaler Förderer Deutsche Bank

Christian May, Fraunhofer FEP

EFECS 2020 - European Forum for Electronic Components and Systems, November 26th 2020

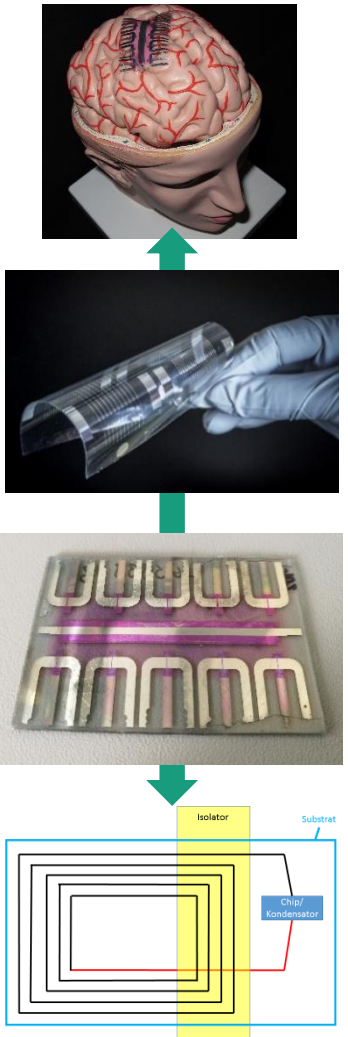


contact: christian.may@fep.fraunhofer.de +49 351 2586 220

Fraunhofer FEP

Biodegradable electronics
Healthcare: Absorbable Implants - Packaging: Fully degradable RFID tag

- Vision: Absorbable implants for temporary application
  - Considered application scenario: Pre-surgical diagnostics of epilepsy: electrodes on cortex of brain, electrical stimulation, electrical signal recording
- Solution: Technologies of flexible electronics (OTFT), use of biodegradable and biocompatible materials.
  Biodegradable structure with
  - conductive paths
  - electrodes and
  - active electronics
  - non-degradable cable connection
- Status: Working OTFT, all materials potentially applicable in absorbable implants



- Problem: RFID widely used in security systems: currently not biodegradable - Alternatives needed to reduce ecological footprint
- Project idea
  - passive RFID made of completely bio-based or even biodegradable materials; communication with commercially available transceiver systems
  - Benefits for the environment: packaging including security system can be decomposed in industrial composting plants, no expensive recycling or waste separation technologies required
- Status: technology to apply patterned Mg on biodegradable polymer substrates available
- Look for partners from the (packaging) industry for development, manufacturing, exploitation

see also https://www.fep.fraunhofer.de/de/ueber-uns/projekte/bioElektron.html

Financial support by the Fraunhofer Internal Programs under Grant No. MAVO 831 301 („Biodegradable electronics for active implants bioElektron“)

For German partners: also funding opportunities with BMBF. FEP funded by BMBF in exploratory phase (10/2020-09/2021) in ideas competition "New Products for the Bioeconomy“.

Fraunhofer FEP

Biodegradable electronics
A contribution to the Green Deal objectives

- Why Biodegradable electronics?
  - Absorbable implants for temporary application
    - must be completely degraded (Si-based only with nano membranes due to low degradation rate in the tissue)
    - Organic and flexible electronics is the technological basis to build everything completely monolithic (cheaper production process, costs) in thin film technology
  - Degradability in environment
    - use Si in small quantities ("sand grain"): useful for complex electronic circuits
    - doesn’t work for large area electronic applications (antennas, light, PV)
      degradation problems cannot be solved by miniaturization if macroscopic components necessary
- Biodegradable electronics
  - Well in line with the European sustainability goals
    - Primarily addressed: The circular economy - “the number one priority”

Biodegradable electronics
Importance of European R&D&I cooperation and the cooperation in the ECS-SRIA

- Biodegradable electronics - brings sustainability to electronic products and electronics to sustainable products
  - => new business opportunities for European companies in sectors, such as environmental sensors, intelligent packaging & health and well-being
  - IoT increasing the amount of electronics products → electronic waste is increasing
  - Digitalization → electronics will be also embedded or released to biological environment
- ECS-SRIA 2021 (draft Nov. 2020):
  - Biocompatible and even biodegradable substrates and packaging materials are required to reduce the environmental impact of the electronics industry, in addition to opening new applications in areas such as wearable and implantable electronics.
  - Roadmap: short term and medium term: topic 2.1 and 4.2
- synergetic use of the excellent competences spread over Europe - connection with flexible electronics community
  - use of the European network of RTOs (e.g. Fraunhofer FEP and IZM with VTT – see our proposal SUSTRONICS)
  - use DIH (e.g. SmartEEs – www.smartEEs.eu)
- Support for “critical” TRL range necessary to bring technology from research to products and bring industry and RTOs together

contact: christian.may@fep.fraunhofer.de +49 351 2586 220

Fraunhofer FEP