

Get in touch with us:



**Dr.-Ing. Christian May**

**Project Coordinator**

Fraunhofer Institute for Organic Electronics,  
Electron Beam and Plasma Technology FEP

*Email: Christian.May@fep.fraunhofer.de*



**Anastasia Grozdanova**

**Project and Dissemination Manager**

Amires s.r.o.

*Email: grozdanova@amires.eu*

Find out more about the project:

**FlexFunction2Sustain**  
<https://flexfunction2sustain.eu>



# OPEN INNOVATION ECOSYSTEM FOR SUSTAINABLE

**NANO-FUNCTIONALISED**

**PLASTIC & PAPER  
SURFACES & MEMBRANES**



# Table of contents

Words from the coordinator	4	Special characterisation portfolio	19
What is an Open Innovation Test Bed?	5	Target markets	20
Benefits and advantages for SME	6	Application examples	21
FlexFunction2SustainOpen Innovation Test Bed	7	Biobased optical films	22
Services at a glance	8	Marine degradable flexible packaging	23
How to approach the OITB ?	9	Selective and switchable membranes	24
OITB technical competences	10	Multifunctional plastic surfaces in automotive	25
Core competences and members	11	Recyclable drink pouches	26
Atmospheric pressure processes	12	Paper-based food packaging	27
Vacuum coating and surface treatment	13	Related projects	28
Facilities for printed electronics	14	Open Calls	29
Surface nano- and micro structuring	15		
Circularity of plastics	16		
Characterisation and quality control	18		



# Transforming innovative ideas to eco-friendly plastic and paper products



The FlexFunction2Sustain Open Innovation Ecosystem unites Europe's leading Research Organisations and Industries for smart and sustainable plastic and paper products. Supported by Business Development Experts, FlexFunction2Sustain transforms novel concepts and technologies to market successful products.



# Words from the coordinator

The FlexFunction2Sustain Initiative aims at creating an Open Innovation Test Bed (OITB) for nano-functionalisation technologies that enable sustainable and smart plastics and paper-based products. The OITB envisages new business opportunities in replacing glass and metal with nano-functionalised plastic or paper surfaces in various products, enabling reductions in weight and cost and mechanical flexibility gains.

FlexFunction2Sustain OITB is a unique ecosystem of research, technology and business development partners to set-up a combined offer of complementary services for boosting innovation. Customers will be able to gain access to a pan European innovation network through a Single Entry Point without the need to speak multiple

languages or to understand the law in multiple countries. This model allows the most appropriate technology selection and shaping among whole technological portfolio available in the EU. Users can expect optimum cost, time-to-market, reliability and performance.

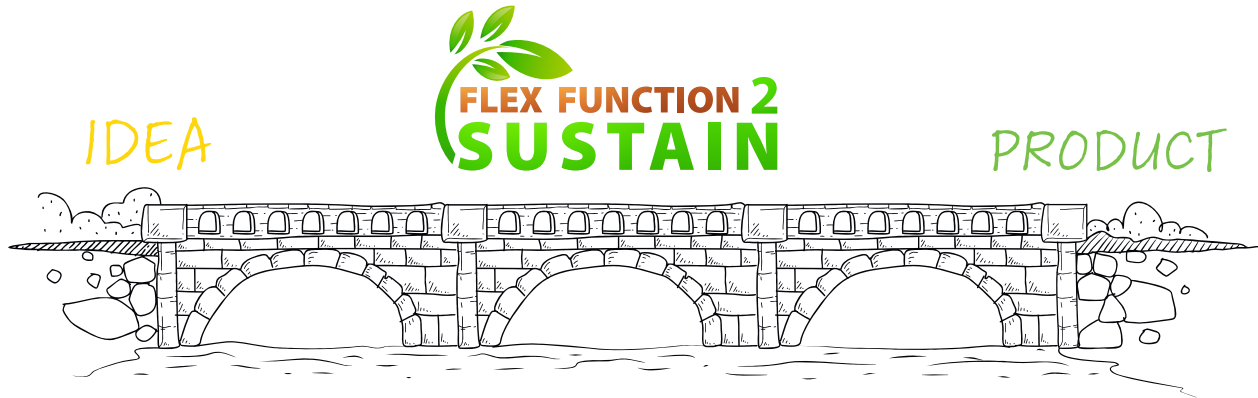


Welcome to the  
FlexFunction2Sustain OITB!



*Dr.-Ing. Christian May,  
Project Coordinator*

# What is an Open Innovation Test Bed?



An Open Innovation Test Bed is an ecosystem with a set of entities providing common access to physical facilities, capabilities and services. The main objective of the OITB is to provide users an easy access to holistic innovation boosting services through a Single Entry Point – the industry's access point to OITB services.

The OITB supports the innovative Start-Ups, SMEs and industries in material and product design, in process and product development, in product verification and certification, with pilot and small series production services and with accessing new markets and business opportunities. Integrating all these services to a complete, all-round offer will substantially reduce the time and cost to progress through the innovation chain from an idea to a successful product.

# Benefits and advantages for SME

*Why should I use an OITB?*

## Holistic services from a single contractor - Single Entry Point (SEP)

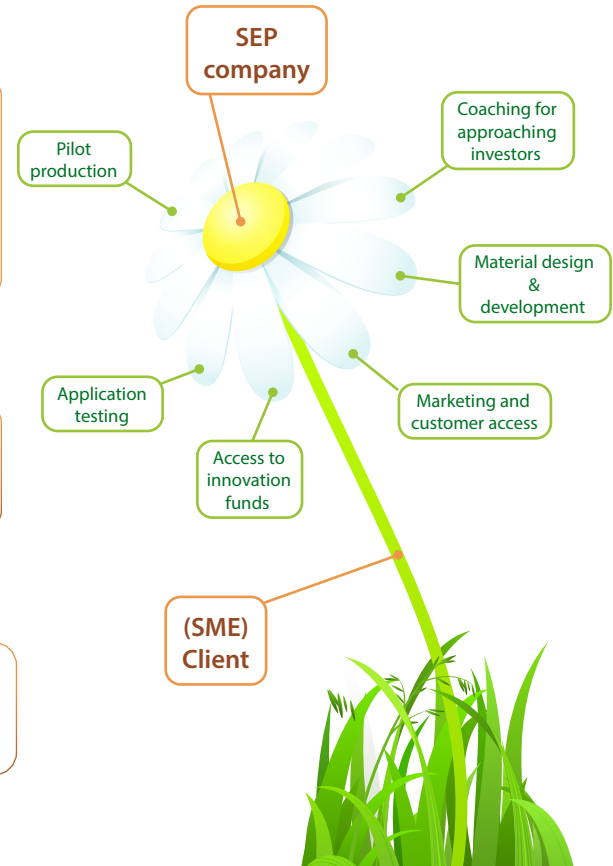
One contract – multifold services focused on customer needs  
Innovation services from more than 10 European countries delivered in either your native language or English  
Renowned experts assemble best-suited, “best value for money” services for your innovation  
Single Entry Point does all management and process tracking

## Integrated business services, coaching and finance access

Link to investors and access to R&I funds  
Consulting for accessing new markets and creating new business models

## Customer-friendly liability and warranty terms

SEP acts as fully responsible general contractor  
Reduce risks in complex innovation processes with multiple partners involved



# FlexFunction2Sustain Open Innovation Test Bed

## Objectives, Vision and Mission

### Our objectives

Position as leading supplier for technical and business innovation services for nanotechnology in plastic and paper processing industry

Support Start-Ups, SME and industry in the whole Single European Market in turning their ideas to market successful products

Establish a successful and sustainable business; maintain and grow the OITB ecosystem and portfolio

Support solving societal challenges through education, standardisation and regulation advice



**Mission:** *We drastically reduce plastic waste in the world through enabling innovations using novel nano-functionalised plastic and paper surfaces.*

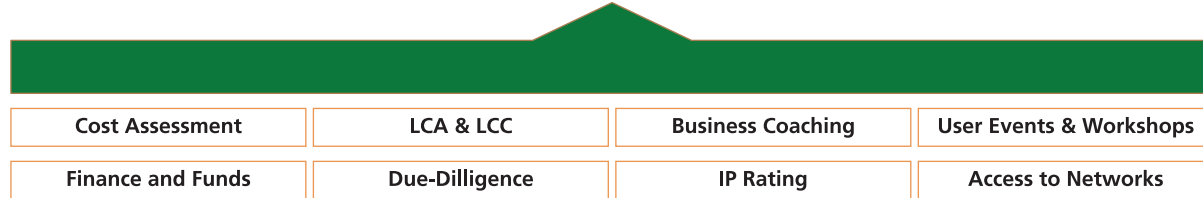


**Vision:** *We are the leading alliance for testing and boosting innovations worldwide in nanotechnology for environmentally friendly and smart plastic and paper products.*

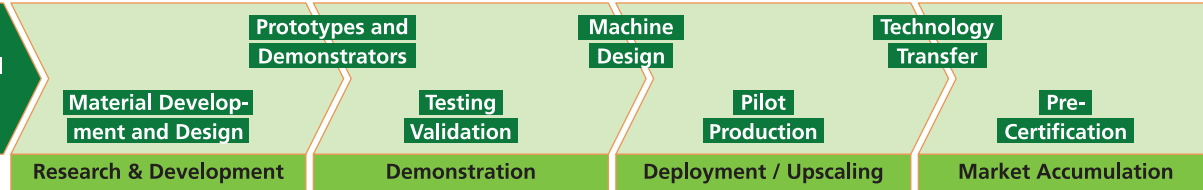


# Services at a glance

## Business and Finance Community



Fundamental Research

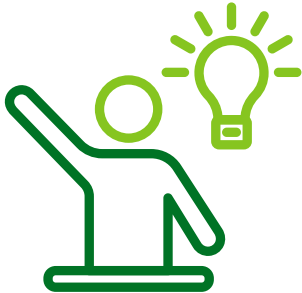


Government

# How to approach the OITB ?

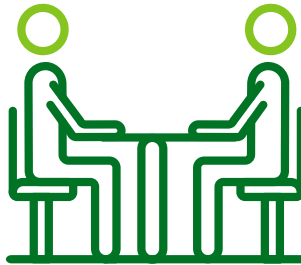
*Open the door to more business with your ideas*

FlexFunction2Sustain offers a one-stop-shop for all requests for services that will be managed by the Single Entry Point company with multiple regional offices distributed all over the European Union.



## Client

Product idea or technical challenge



## For-profit

Single Entry Point



## FlexFunction2Sustain

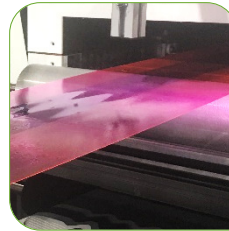
OITB Services

The Single Entry Point manages all relationship between the client and the OITB members in order to offer an easy access of clients to our services.

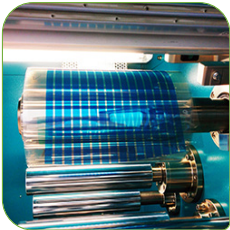
# OITB technical competences



**CIRCULARITY BY DESIGN**



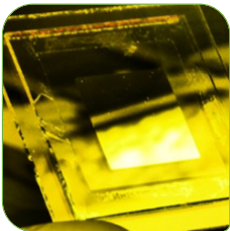
**ROLL-TO-ROLL  
ATMOSPHERIC  
PRESSURE COATING &  
SURFACE TREATMENT**



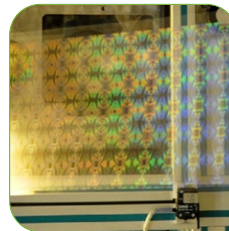
**PRINTED AND FLEXIBLE  
ELECTRONICS**



**VACUUM ROLL-TO-ROLL  
COATING AND SURFACE  
TREATMENT**



**FUNCTIONAL  
CHARACTERISATION  
AND APPLICATION  
VERIFICATION**



**ROLL-TO-ROLL  
NANOIMPRINT  
LITHOGRAPHY**

# Core competences and members

OITB members are leading European institutes and companies, which combine their competencies, expertise and infrastructure to provide the industry innovative solutions in the field of nano-functionalised materials.

The OITB core competences cover:

- Efficient structures for EU wide collaboration between R&D and industry
- Technology and innovation rating and evaluation
- Lab-to-fab facilities for boosting technologies
- Pilot manufacturing facilities for all major nano-surface modification techniques
- Business development, intellectual property expertise and investor relations
- Knowledge gathering and preservation for sustainable plastics

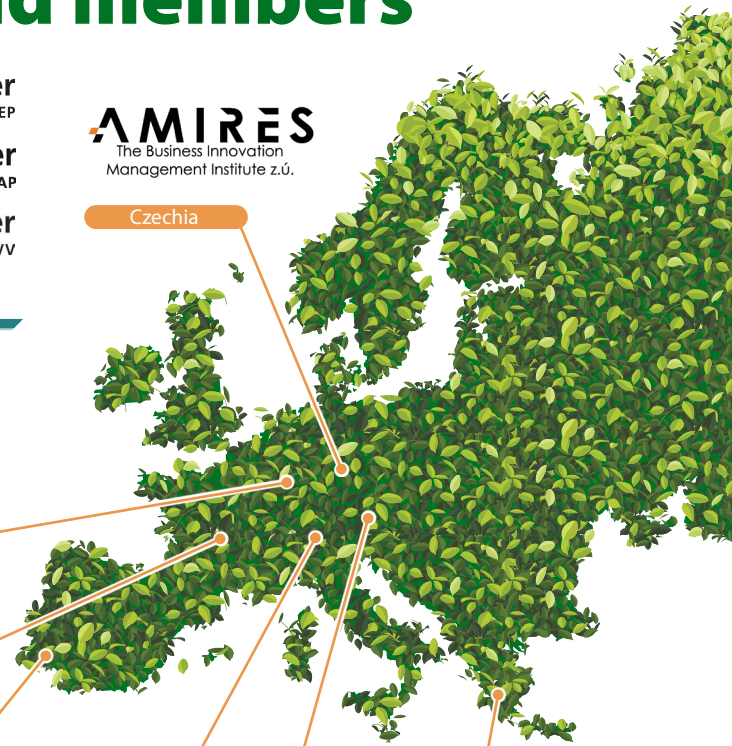
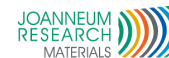


Germany

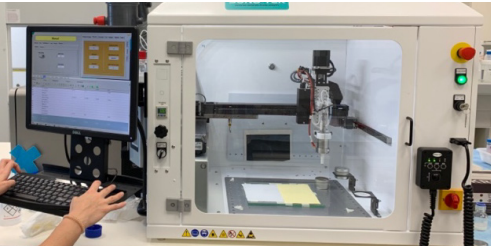


France

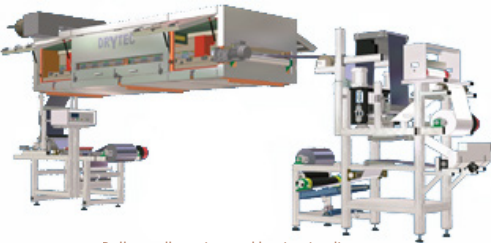
Portugal



# Atmospheric pressure processes



SonoTekexacta coat ultrasonic spray system at INL



Roll-to-roll coating and lamination line at Fraunhofer IVV



Multifunctional capable coating machine for gravure coating and slot-die coating of paper and plastic at Coatema

## Specification table :

- Roll-to-roll and sheet-to-sheet process on lab and pilot scale
- Substrates: plastic webs, paper and metal foils
- Sample size roll-to-roll: 550 mm web width and 500 mm working width
- Sample size sheet-to-sheet: 360 x 360 mm
- Coating technologies: intermittent and continuous slot-die coating, ultrasonic spray coating, doctor blade, engraved roller, 3-roller coating system, 5-roller coating system, kisscoater, commabar, reverse commabar and foulard
- Printing technologies: rotatory screen printing, inkjet printing and flexo printing
- Deposition of material in dust free environment
- Deposition of materials and lamination in inert atmosphere
- Aligned multi-layer printing using registration
- In-line metrology and thickness control tools
- Drying technologies: roller based horizontal and arched hot air convection dryer, hot air flotation dryer, UV-, IR- and NIR-dryer
- Process speeds: 0.1 – 80 m/min



# Vacuum coating and surface treatment

Fraunhofer FEP



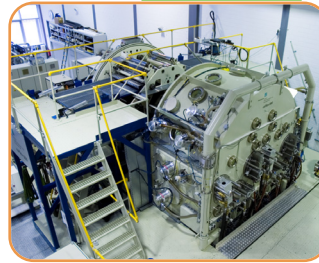
A4 sheets  
1 process

Fraunhofer FEP



200 mm  
3 stations

Fraunhofer FEP



650 mm width  
5-6 stations

AMCOR



715 mm ... 2000 mm  
width

## Specification table:

- Processes: Magnetron sputtering, PECVD, high-rate evaporation, atomic layer deposition
- Substrates: plastic film, paper, biodegradable polymer webs, metal foils, polymer membranes
- Contactless, defect free winding
- One pass multilayer deposition (up to 6 layers)
- Web speed range from 0.1 to 600 m/min with roll lengths up to 1000 m
- In-line evaluation of transmittance, reflectance, sheet resistance and surface defects
- Nano-composite coatings with high-purity nanoparticles by gas-phase aggregation in PECVD matrix (Sheet-to-sheet process)

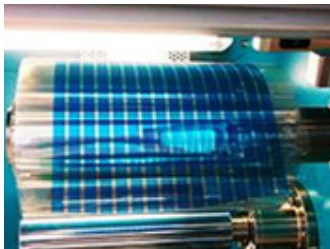
# Facilities for printed electronics



Panoramic view into the cleanroom at Fraunhofer IAP with sheet-to-sheet pilot line for printed organic electronics devices



Roll-to-roll printed electronics pilot line at Nanotechnology Lab LTFN, Aristotle University of Thessaloniki, Greece



OET, Greece: Organic solar cell at the Aristotle University of Thessaloniki roll-to-roll pilot line

## Specification table :

- Full process chain to make and integrate printed electronic devices and encapsulated modules
- Sheet-to-sheet processing on 150 mm x 150 mm
- Roll-to-roll processing on 300 mm web width
- Deposition techniques:
  - At ambient pressure: inkjet printing, gravure printing, slot-die coating, screen printing, laser patterning
  - In vacuum: thermal evaporation and OVPD deposition of functional organic semiconductors
- Machines installed in clean rooms (class 10 ... 1000) and processing in inert atmosphere
- Encapsulation techniques: Thin film encapsulation with atomic layer deposition; lamination of glass sheets or permeation barrier films
- Device examples: organic solar cells, organic light emitting diodes, printed sensors and wireless antennas

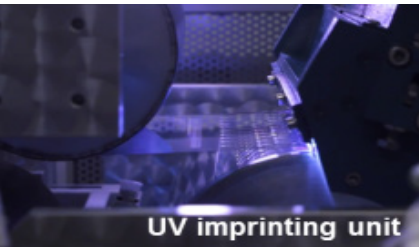
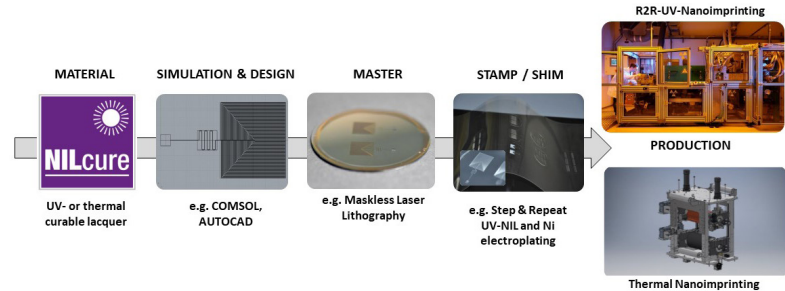


Sheet-to-sheet pilot line for printed organic electronics devices at Aristotle University of Thessaloniki

# Surface nano- and micro structuring

## Specification table :

- Lamination by UV-curing and/or thermal curing
- Web width 250 mm
- Web speed range: 0.5 - 30 m/min
- Dust protection by Laminar Flowbox, Click&Coat Box
- Circularity by design material concept: recyclable and/or biobased and/or biodegradable substrates and UV-lacquers
- Micro/nanopatterning by UV-nanoimprinting or hot embossing (max. 200°C)
- Direct patterning of polymer foil substrates or patterning of surface coatings based on tailored UV-lacquers on polymer foil substrate
- UV curing by UV-LED (max. 14 W/cm<sup>2</sup>, 365nm or 395nm) or by Hg-Vapor Lamp



Coatema roll-to-roll nanoimprint at JOANNEUM RESEARCH





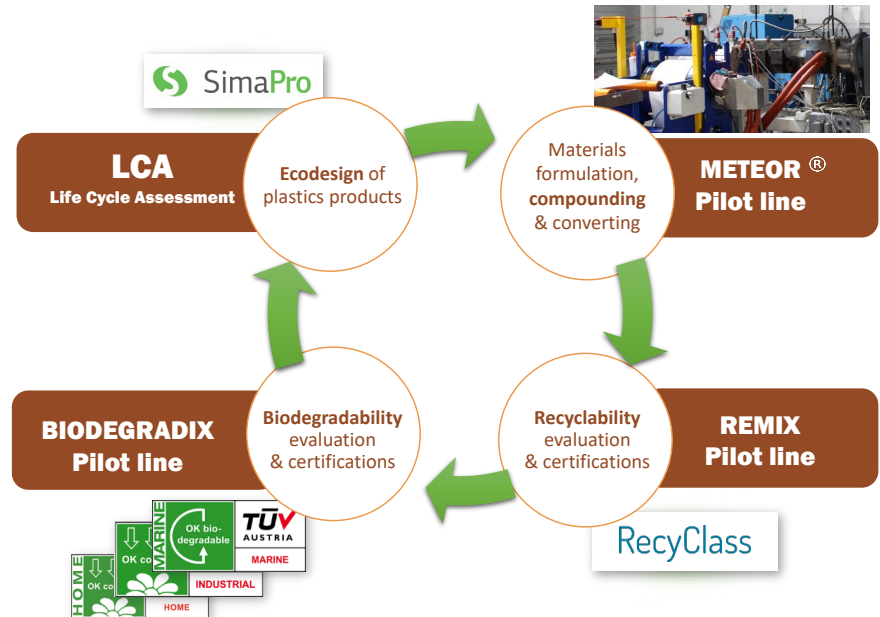
# Circularity of plastics

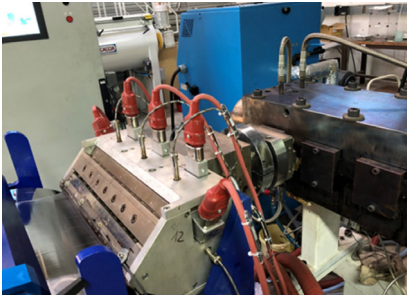
These facilities clusters are dedicated to supporting the development of a “Circularity by Design” service, that includes Life Cycle Assessment (LCA), and Eco-Design of materials and plastic products, towards pre-certification of recyclability, biodegradability, and compostability.

Life Cycle Assessment according to ISO 14040 & 14044

- More sustainable end-of-life scenarios
- Quantify benefits of sustainable products
- Assist suppliers and clients in eco-design decision making
- METEOR®: compounding and converting new formulations based on recyclable, bio-based, or bio-degradable materials
- REMIX / BIODEGRADIX: recyclability, biodegradability, and compostability testing following RecyClass and TUV Austria protocols

The combination of these pilot lines allows the implementation of a holistic Circular Economy approach in order to support the OITB clients in developing new environmentally harmless products.





METEOR® pilot line at IPC

### METEOR® pilot line:

- Compounding and specific material formulations development with an efficient dispersion of additives while reducing the thermo-mechanical degradation of the material
- Film coextrusion, with a flat die, and film take-off station
- High temperatures, up to 350°C,
- Compounding process throughput range: from just a few kgs/h up to 100 kg/h
- Line speed - 1 to 20 m/min
- Films thickness range - 25 to 250 micron
- Films width - 300 to 330 mm



Examples of converting steps: (top): blown film extrusion, film take-off station, (bottom): injection molding facility, tube and profile extrusion machine (at IPC)

### REMIK pilot line:

- Comprehensive qualification of plastic waste down to the complete technical datasheet of the recycled materials
- Allows working at semi-industrial scale with 100 to 200 kg batches
- Equipped with: shredding, flotation, washing, and drying machines for plastic flexible films, NIR sorting, electrostatic, and tribo-electrostatic sorting machines, extrusion and filtering machines
- Recycled materials can be converted back into films, sheets or containers, as needed, with the broad choice of equipment available at IPC



BIODEGRADIX pilot line at IPC

### BIODEGRADIX pilot line:

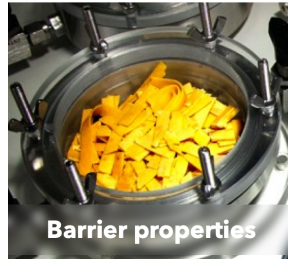
- Equipped with respirometers, up to 60 channels, to perform aerobic or anaerobic biodegradability tests, in compost or marine environment
- Equipped with two 12 Channel respirometers to perform aerobic or anaerobic biodegradability tests.
- IPC also has a range of cutting mills available for the shredding, grinding, or milling of different types of materials including rigid and flexible plastics.

# Characterisation and quality control

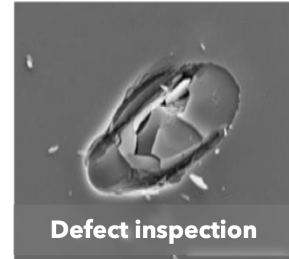
Physico-chemical and surface characterisation and functional performance verification

Application integration and verification

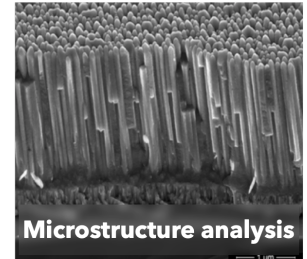
Compliance and Material Safety Verification



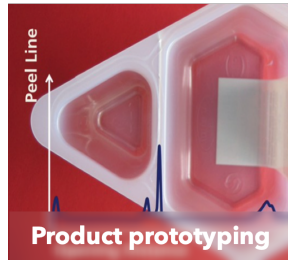
Barrier properties



Defect inspection



Microstructure analysis



Product prototyping



Integrity and Durability tests



Functionality in application



Migration testing



Nano Safety

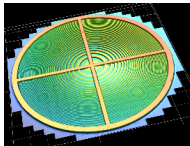


Compliance assessment

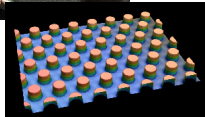
Characterisation and Verification Workflow

# Special characterisation portfolio

## Surface and structural characterisation

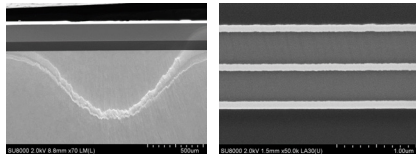


Large area confocal microscope



## SEM cross-section imaging

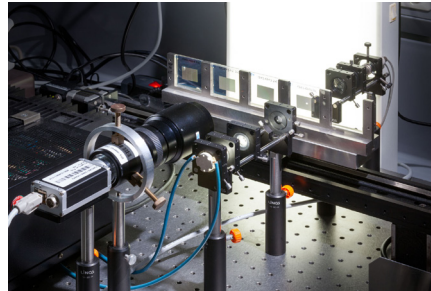
- Morphology and structure evaluation
- Defect detection



## Functional characterisation testing

### Mechanical testing with in-line WVTR characterisation

- Coupling of optical calcium test for WVTR with mechanical bending test in device geometry
- Sensitivity down to  $10^{-6} \text{ g}/(\text{m}^2\text{d})$



### Permeability down to $10^{-6} \text{ g}/(\text{m}^2\text{d})$

- Sempa HiBarSens 2.0 HT



## Application approval and safety testing

### Food packaging plant and food contact laboratory

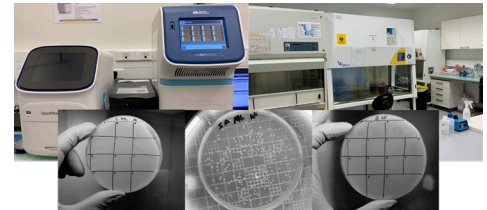
- Full FCM characterisation
- ISO 9001:2015 certified facility

### Safety assessment

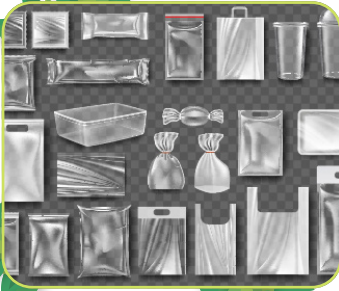
- Toxicological analysis of nanomaterials
- Imaging of nanomaterial-cell interactions (ISO 9001:2015 certified facility)

### Rapid testing of antimicrobial surfaces

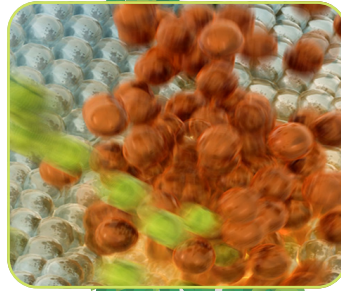
- Antiviral activity by qPCR/RT-qPCR



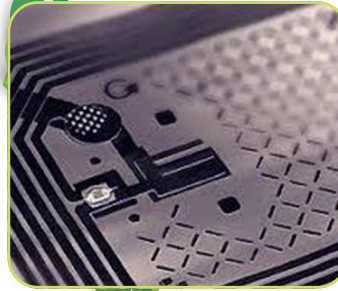
# Target markets



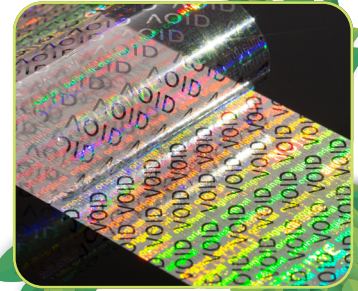
*Sustainable  
smart  
packaging*



*Surfaces &  
membranes  
in bio  
applications*



*Plastic and  
paper  
electronics*



*Optical films  
for security  
and design*



# Application examples

## *Research meets industry*

FlexFunction2Sustain's technical facilities and the performances of novel nano-functionalised surfaces will be demonstrated and validated by Europe's leading companies within six industrial application scenarios.

### Industrial validation in 6 use cases



Biobased optical films



Marine degradable flexible packaging



Your Companion  
Life Science Filtration

Selective and switchable membranes



Multifunctional plastic surfaces in automotive



Recyclable drink pouches



Paper-based food packaging

# Biobased optical films

## HUECK FOLIEN

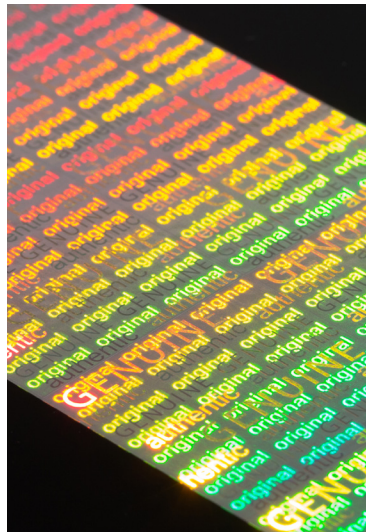
**Objective:** introduce bio-based or recycled substrates and bio-polymer based resins in optical films.

FlexFunction2Sustain is an important project in this context and supports us in a sustainable product development. In our state-of-the-art laboratories, a team of experts considers and researches the basic principles and solutions for individual customer requirements. Environmentally compatible raw materials are used according to technical possibilities. The use of so-called "bio-plastics" always finds place in discussions. We have been successfully using recycled PET for high-quality furniture surface films since 2019. Further products with recycling foils, especially for Labelling, are in development. As a manufacturing company, we bear a special responsibility for our environment. We therefore rely on energy efficiency and resource conservation. With our commitment to sustainability, we focus on careful management of limited resources.

**Dr. Stephan Trassl**  
Project Manager Research

Optical temper-evident features on packaging are used to protect food and pharmaceutical products. Premium lamination films are used for the decoration of interior design. Both products are manufactured using synthetic (non-degradable) resins on plastic films. Today, no in-line process control for fidelity of optical structures is available, so that continuous quality control in a cost-effective roll-to-roll manufacturing is not available.

Thus, this application case will implement existing roller-based technologies for high throughput large area fabrication of optical films onto bio-degradable plastics. The use of bio-degradable resins will further improve compostability of valuable polymer material.



Lamination films by HUECK Folien

### Our ambition is to achieve and demonstrate

- High throughput large area fabrication and continuous quality control of optical layers onto bio-based or recycled plastics through implementation of in-line process control with full LCA
- Bio-based resins based on biopolymers like cellulose, vegetable oils or polylactic acid maintaining their biocompatibility as well as printability and production speed
- Fully industry-compostable / biodegradable optical films onto bio-degradable plastics (TÜV Austria Certificate "OK compostable")
- In-line process control enables accelerated development times.

HUECK Folien optically variable feature imprinted into a bio-based resin on a biobased PLA-film substrate

# Marine degradable flexible packaging

*Procter & Gamble*

The Procter & Gamble Company is a world leading supplier of consumer goods offering a wide range of products for personal health, personal care and hygiene. As part of a holistic, multi-faceted innovation strategy, we are continuously seeking and developing solutions that enable consumers to have more environmentally responsible product choices. Recently, a wide range of novel bio-based and marine-degradable polymers have emerged that are potentially suitable for sustainable packaging of our products in certain situations. FlexFunction2Sustain supports us in evaluating, and potentially selecting, marine-degradable polymers as a sustainable packaging solution when and where it makes sense and supported by sound environmental science. Relevant technical expertise in the FlexFunction2Sustain consortium covers not only degradability, but the whole packaging technology, accelerating the time to market for sustainable packaging solutions.

*Pier-Lorenzo Caruso*  
*Technology Manager*

**Objective:** develop less environmentally persistent materials for flexible packaging

Currently, flexible packaging in Fast-Moving Consumer Goods (FMCG) requires H<sub>2</sub>O permeation barrier and the mechanical strength needed to withstand the converting and sealing process without damaging the barrier. The starting point are non-degradable polymers based on mineral oil in combination with aluminium barrier. FMCG products may be stored longer than 1 year in state of the art storage, provided with sufficient moisture barrier performance.

## Our ambition is to:

- Enable marine degradable flexible packaging based on marine degradable non-plastic materials
- Deliver a moisture permeation barrier
- Demonstrate sealing performance without losing moisture barrier performance
- Demonstrate shelf life of longer than 9 months (accelerated aging + real storage)
- Gain 3rd party certification for “marine degradable” packaging



Recyclable and marine degradable flexible packaging structure



# Selective and switchable membranes

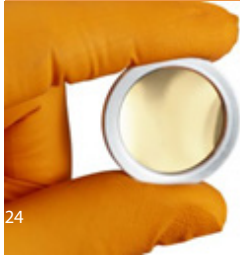
## i3 Membrane

**i3** Membrane aims at next generation membrane techniques as we believe that membranes can do more than just filter.

Combining the potentials of polymer membranes and conductive metal coatings, we strive for the creation of digital membrane chromatography solutions that enable higher product throughputs with lower buffer media consumption compared to the state of the art.

Being a use case partner in the FlexFunction2Sustain project, offers us the unique opportunity to get access to leading edge ultra-thin film technologies and co-develop new processes with technology leaders.

*Dr. Florian Schmitt*  
CTO



Case 2: gold coated polyester membrane for particle analysis of pharma liquids (case 2)

**Objective:** develop double-sided roll-to-roll coating of conductive layers on polymer membranes for electrically switchable filters in medical/biotech (case 1) and for particle analysis in pharmaceutical liquids (case 2).

Metal coated polymer membranes (Polyamide) have the ability to add digital properties by applying a voltage to adsorb and desorb charged biomolecules such as monoclonal antibodies. Active filter membranes increase market potential to e.g. syringe filters and other biotech filter applications (figure - case 1).

Gold coated polyester membranes are used in pharma industries for particle analysis of liquids. Covid19-related increasing demands for particle monitoring of active agents trigger efforts to achieve higher production throughputs for membrane metallisation (figure - case 2).

Polymer membranes turned out to be a challenging material for industrial high-volume coating technologies (roll-to-roll processing). Therefore, the State of the art is sheet-to-sheet production (5 membranes in 8 hours) with limited yield (75%). Electrically switchable membranes are not available on the market. Specific adsorption / desorption usually is done by time intensive pH-shift processes.



Case 1: Membrane based syringe filter (left) and capsule filter (right) by i3 Membrane (basic design for case 1)

### Our ambition is to:

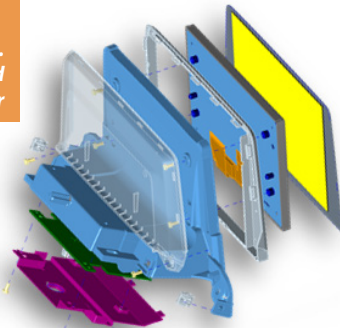
- Increase productivity to at least 50 membranes/8h by implementing a roll-to-roll process
- Increase yield to > 97% (apply in-line monitoring strategies)
- Optimise metal coating characteristics (e.g., mechanical stability) and membrane performance (e.g. flux)
- Develop a robust interconnection technology to apply electrical voltage to the membrane
- Application robust metal layers on ultra thin membranes under influence of electrical voltage and fluids

Information videos on I3M technology for [syringe filters](#) and [particle analysis](#)

FlexFunction2Sustain project perfectly matches Centro Ricerche FIAT's expertise and targets because surface technology and sustainability are key technologies for vehicle of the future. The first mission of the CRF is the promotion and the investigation of novel materials, technologies and systems for the automotive sector. Project FlexFunction2Sustain goes in such direction: improving technologies and materials suitable for display touchable surfaces and at the same time increase the sustainability of the component ensuring high quality in products and components. CRF involvement will target to investigation and application of sustainable transparent films for on board infotainment devices to achieve high quality components after aging. Using sustainable materials coming from recycling processes, we matches one of the main target of the future as the global sustainability.

**Nello Li Pira, Ph.D.**  
**Global Materials R&I and Roadmaps Manager**

Structure of central instrument display



# Multifunctional plastic surfaces in automotive

## Fiat Research Center

**Objective:** development of display cover lens with touch functions, high quality optical output (anti-reflection, anti-glare, anti-fingerprint) and high mechanical-chemical robustness using sustainable materials.

Touch surfaces of car infotainment and entertainment display need to be combined with both electronics functions and optical clarity and scratch resistance / anti-fingerprint properties. On current components, anti-scratch surfaces are limited in the market to high-gloss effects. The introduction of optical functions as anti-reflection, anti-glare, anti-fingerprint is still challenging due to the limitation in materials availability, manufacturing processes as well as integration in targeted 3D geometry and high curvatures. The integration of printed electronics functionality (sensors; signage symbols and others) is also not available today.

### Our ambition is to:

- Combine anti-scratch, anti-reflective and anti-fingerprint surface with electronic functions (capacitive or proximity sensors) on a flexible plastic surface to be integrated to complex 3D surfaces in car dashboards compliant to automotive standards
- The use of resins from recycled and recyclable materials will give us the opportunity to introduce sustainability notice within interior vehicle



# Recyclable drink pouches

## Capri Sun

Capri Sun as a world leading brand has clearly committed to become the world's most sustainable kids drink as part of the company's sustainability agenda. Therefore, our ambition is to seek and develop sustainable packaging solution made out of recyclable mono-material. To underline our efforts we are proud of being a use case partner of the FlexFunction2Sustain project, fulfilling the overall objective to set a new benchmark on the market when it comes to recyclable pouches assigned for beverage consumption. Within this consortium everyone can favor and benefit from partners strength and capabilities in this field.

*Beatus Schehl,  
Research & Development Director*

*Jakub Pedzinski, Senior Packaging  
Innovation Manager*

**Objective:** development of a „Recycle Ready Pouch“ made from mono-material to facilitate recycling; introduce a recyclable polymer laminate with sufficient barrier and light blocking properties (thin film nanomaterials) for mono-material drink pouches.

Currently, there are highly mechanical stable liquid pouch for fruit juice with very good water vapour and oxygen barrier properties for a shelf life of longer than 6 months. State of the art is the usage of 3 layer laminates (PET/ALU/PE) that are practically impermeable to water vapour and oxygen and therefore, highly protective for the fruit juice allowing storage and shelf life longer than 1 year. However, the materials are not recyclable because of the use of 3 different materials.

### Our ambition is to:

- Replace the drink pouches by fully recyclable mono-material laminate (using either polyolefin based polymers or biopolymers) in which the gas barrier performance is provided by thin film nanomaterials such as evaporated AlOx or PECVD deposited SiOx with a wet coated planarisation layer
- Demonstrate WVTR < 1 g/(m<sup>2</sup>d) and OTR < 10 cm<sup>3</sup>/(m<sup>2</sup>d) (both at 23°C / 50% r.h.) on 100 m long rolls
- Demonstrate assembly of drink pouches
- Demonstrate food-safety compliance and 100% recyclability (< 5 mass.% impurities)
- Demonstrate potential cost competitiveness with state of the art solutions



# Paper-based food packaging

SONAE MC

Sonae MC as a leading food retailer is strongly committed to reduce the carbon footprint of its operations putting the people and the planet first. Particularly for plastics materials our ambition is to enforce a culture of reduce, reuse, recycle seeking to co-develop and test sustainable packaging solutions that address those criteria. To underline our efforts, we are proud of being a use case partner of the FlexFunction2Sustain project, fulfilling the overall objective to set new benchmarks on the market when it comes to packaging solutions (films, bags, trays, etc.) assigned for fresh and organic products, in a cooperative, science-based approach which allows the advancement of knowledge and its transfer to the market where our organization performs its role as a testbed for innovation.

*Marlos Silva*  
Director of R&D and Incentives

**Objective:** development of paper-based food packaging that can act as an alternative to existing plastic packaging, ensure a better performance of paper packaging (when compared to existing paper-based packaging) and ensure a better recyclability/ biodegradability of paper-based packaging.

Currently, there are flexible paper with enhanced mechanical and barrier properties (against H<sub>2</sub>O/O<sub>2</sub>, mineral oil, grease resistant) and active functions (e.g., antimicrobial or antioxidant) extending shelf-life of paper packed fresh food and helping replace plastic packaging for groceries. The synthetic waxes, plastics, or lacquer layers enhance barrier properties and enable direct food contact, but current coatings prevent recycling of package.

## Our ambition is to:

- Develop new paper-based food packaging to be tested in selected food items
- Introduce “green” processes, e.g., electrohydrodynamic coating or ultrasonic atomisation for eco-friendly, active coatings based on nano-structured biopolymers, natural waxes and natural antimicrobial compounds
- Demonstrate hydrophobic/oleophobic, antibacterial surface on paper for extended shelf life of paper-packaged



Example of current plastic based fresh food packaging at SONAE



Selected food items and their current packaging

# Related projects

## INN-PRESSME

open innovation ecosystem for sustainable plant-based nano-enabled biomaterials deployment for packaging, transport and consumer goods

<https://www.inn-pressme.eu/>

## OASIS

open access single entry point for scale-up of Innovative smart lightweight composite materials and components

<https://project-oasis.eu/>

## SAFE-N-MEDTECH

safety testing in the life cycle of nanotechnology-enabled medical technologies for health

<https://safenmt.eu/>

## TEESMAT

open innovation test bed for electrochemical energy storage materials

<https://www.teesmat.eu/>



## NEXTGENMICRO-FLUIDICS

next generation test bed for upscaling of microfluidic devices based on nano-enabled surfaces and membranes

<https://www.nextgenmicro-fluidics.eu/>

## NEWSKIN

innovation ecosystem to accelerate the industrial uptake of advanced surface nano-technologies

<https://www.newskin-oitb.eu/>

## MDOT

medical device obligations taskforce

<https://mdot.eu/>

## FORMPLANET

sheet metal forming testing hub

<https://formplanet.eu/>

## INNOMEM

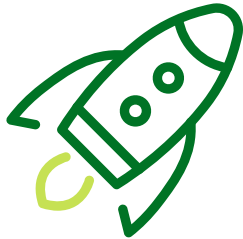
open innovation test bed for nano-enabled membranes

<https://www.innomem.eu/>

FlexFunction2Sustain interacts with relevant regulatory and standardisation bodies. The intermediaries include thematic scientific and industry associations such as EUPC, EPPN, EMMC, EMCC, Nanosafety Cluster and others. On the standardisation aspect, FlexFunction2Sustain contributes to new standards developments in specific topics, promoting the inclusion of the project outcomes in new or future standards that can be easily used by the European or international industry. Thereby, standardisation relevant results will be actively discussed with external stakeholders e.g. OE-A or the Plastics Recyclers Europe Association.

# Open Calls

*Get ready, get involved*

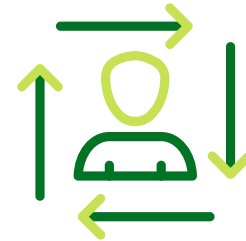


A selection of up to 20 pre-commercial business cases utilising the FlexFunction2Sustain OITB offering will be made following the open calls with cut-off dates in:

- 28 January 2022
- 29 July 2022
- 27 January 2023



Addressed to interested external companies, the call will aim at the provision of a subsidised support to the selected pilot cases.



The customer feedback from pre-commercial service demonstrations will be used to tune the OITB offering.



Find out more information on :

<https://flexfunction2sustain.eu/open-calls/>