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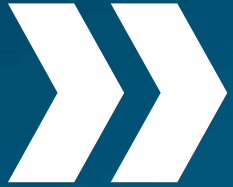
Fraunhofer UMSICHT

Insights in Circular and Bio-based Plastics Activities

Dr. Jochen Nühlen

Dr. Philip Mörbitz

K2022 - Joint event Plastindustrien and kunststoffland NRW | Düsseldorf | 24.10.2022



...Overview who we are and how we work in the field of plastics

...Ways to work with Fraunhofer UMSICHT

...Ideas for collaboration

Fraunhofer-Gesellschaft

World's leading applied research organization

Joseph von Fraunhofer



Budget

2,9 bn €

Industrial

35 %

Employees

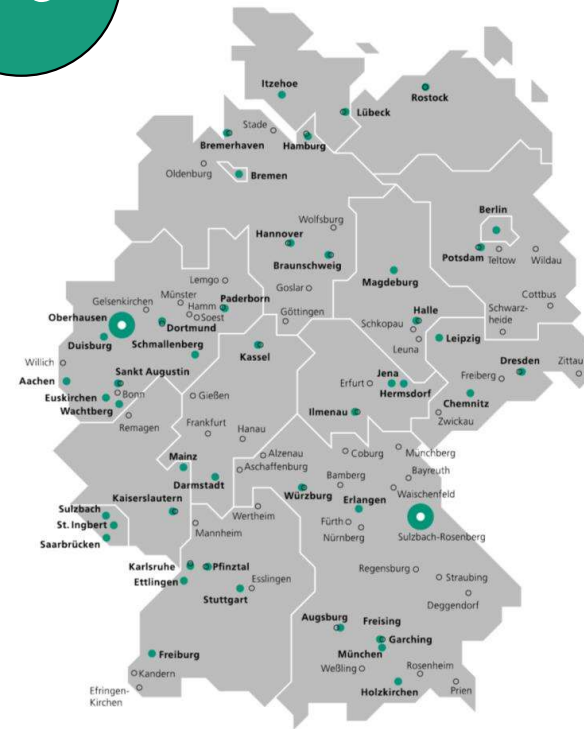
30.000

FhG international

Europe
Asia
Middle East
USA

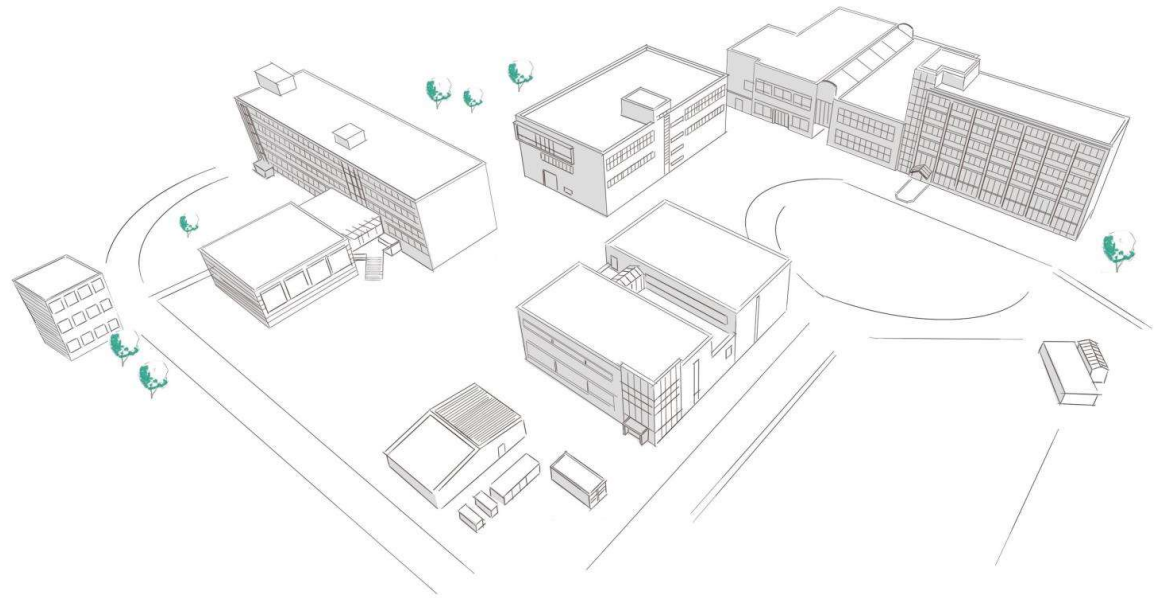
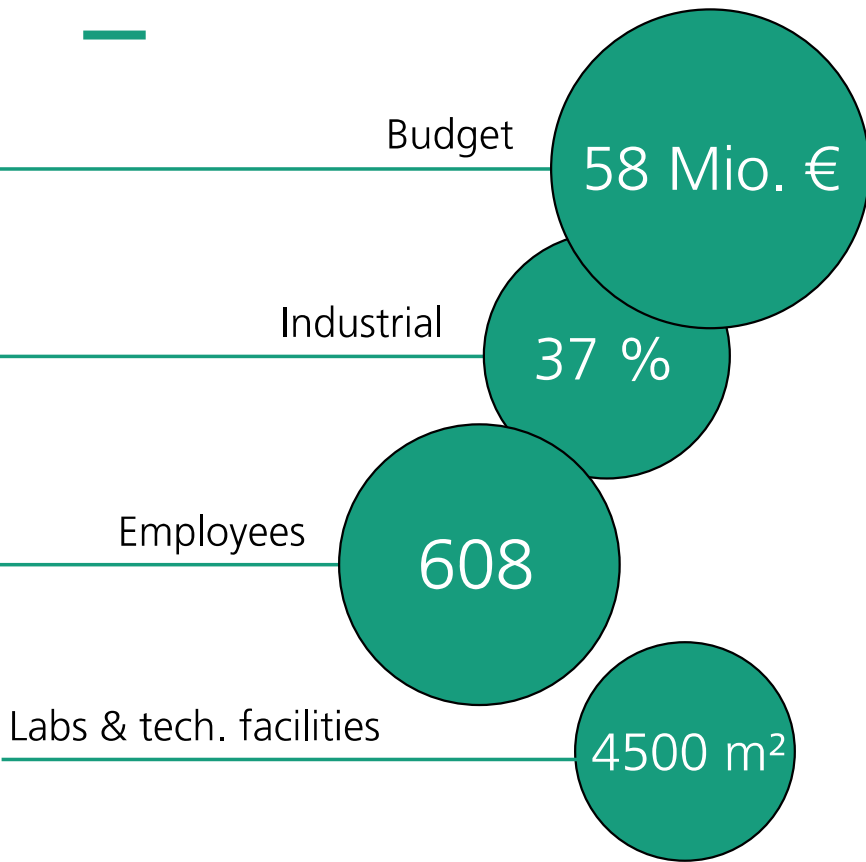
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Institutes



Fraunhofer UMSICHT

Pioneer for a sustainable world



Strategy UMSICHT.2025

Fraunhofer UMSICHT develops climate-neutral energy systems, resource-efficient processes and circular products.

Fraunhofer UMSICHT | Department Circular and Bio-based Plastics

Team of 26 People at 2 Locations

1

Group
Polymer Technology

2

Group
Plastics Development

3

Group
Production Scale-Up and Testing

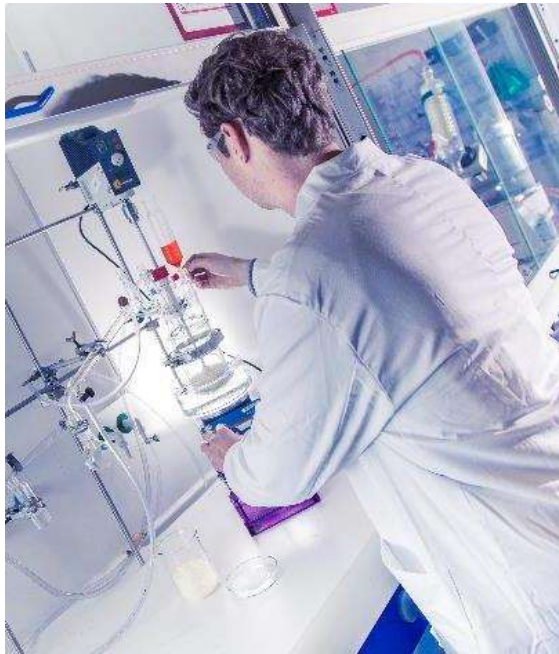
Focus

»We develop **customized compounds** and additives from biobased plastics that are high-quality, sustainable, recyclable and/or durable for a variety of applications like films, fibers, filaments, injection molded parts, and others.

»Our scientific focus is on **rheology and morphology** of bioplastics«

Fraunhofer UMSICHT | Circular and Bio-based Plastics

What can we offer for you?



From Monomer to Polymer



From Polymer to Material



From Laboratory to industrial scale

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➔ accompanied directly in-house by LCA and Circularity experts



Circular and Bio-based Plastics Project examples

Novel bio-based components for adhesives

Development of backbone polymers and additives

Key drivers: legal regulations, sustainability, added value/performance, raw material supply and changes in raw materials

Adhesive components development

- Backbone polymers, basic polymers
- Functional co-monomers

Adhesive types

- Solvent-based adhesives
- Pressure sensitive adhesives (PSA)
- Hot melt adhesives

Requirements

- Crystallization-free
- Elastomeric properties
- High cohesion (internal strength)

Basic material

- Polylactic acid (PLA), Polyhydroxyalkanoates (PHA)



Novel bottles made from bioplastics

In a joint project from bottle to bottle

The entire value chain, from additive synthesis and material development to the final application of the bottles for an innovative cleaning agent and products for organic farming, such as plant growth-promoting soil additives

Formulation development | Basic material

- Polyhydroxyalkanoate (PHA)

Requirements

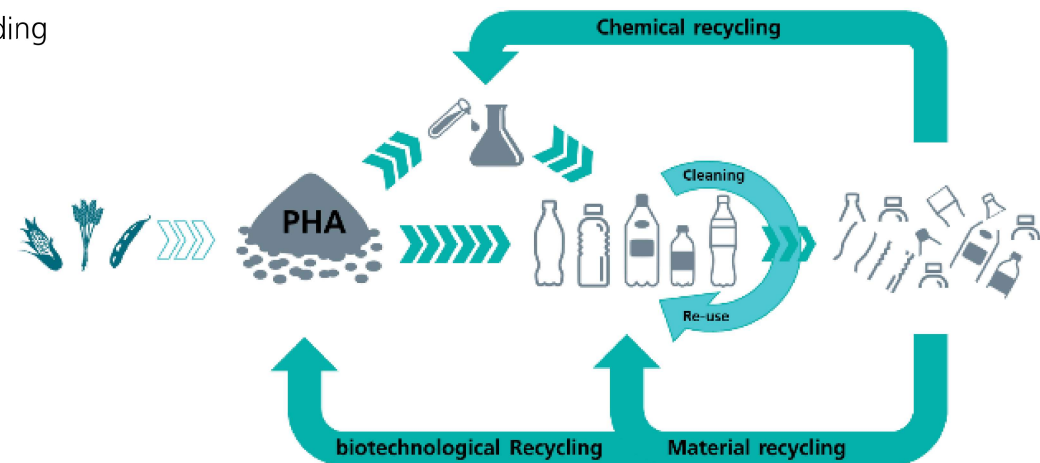
- Processability
- Mechanical stability
- Good barrier properties
- Biodegradability
- Recyclability

Process

- Fermentation
- Synthesis
- Compounding
- Extrusion blow molding

Recycling concepts

- Chemical
- Materially
- Biotechnological



Development of bio-based plastics for technical products

Substitutes for conventional plastics

Substitutes for conventional plastics such as ABS (acrylonitrile-butadiene-styrene copolymers) or PC (polycarbonates) in technical injection-molded components

Formulation development | Basic material

- Polylactic acid (PLA)

Process requirement

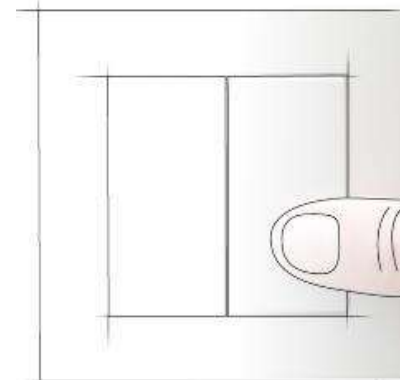
- injection moldable

Requirements

- Dimensional stability
- Flame retardant
- Impact resistant

Application focus

- Electronics and building sector
- Lights or switches and buttons in building technology



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Intermediate from industrial spent coffee grounds (SCG)

Ideas for the second most important commodity after crude oil

Development of industrially scalable approach for converting commercially available spent coffee grounds (SCG) from the industrial production of soluble coffee into high-quality intermediates.

Utilization concepts

- Spent coffee ground as raw material in papers/cartons
- Coffee oil as raw material for the synthesis of functional additives

Development | Process

- Extraction
- Epoxidation
- Polymerization

Meaning | Customer

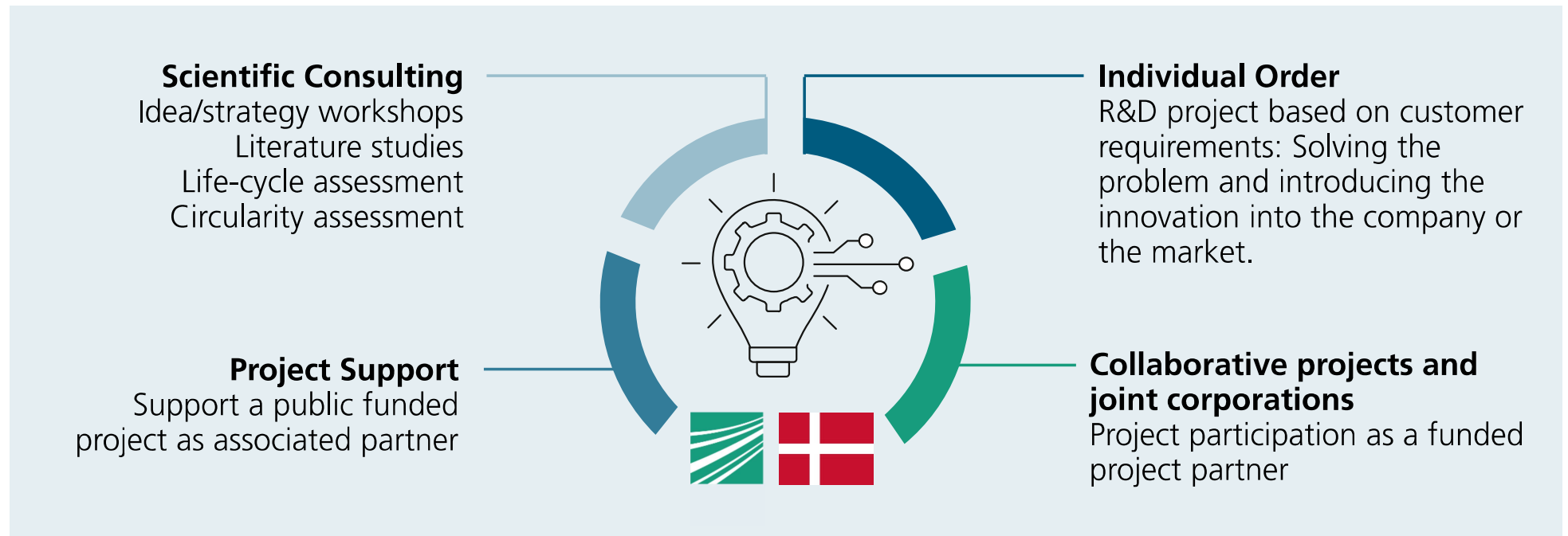
- New process route
- Coffee oil - no food product
- Application range



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Cooperation models

Collaborate with Fraunhofer UMSICHT



Potential matches?

Some initial thoughts...

- Technical components for the Electrical and Electronic equipment sector - flame retardant, impact resistant and heat resistant.
 - Bio-based (monolayer and multilayer) films e.g. for packaging or construction applications
 - Bio-based particle foams as EPS substitutes
 - Bio-based coating materials e.g. for paper
-
- **...Not conclusive! Your needs and pain points?**

Contact



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Cooperations

From monomer to polymer

Our main expertise is the development of bio-based and biodegradable polymers and additives.

Development of polymers based on renewable raw materials

- Polyaddition, polycondensation
- Design of the polymer structure

Development of functional additives for:

- Plastics
- Adhesives
- Lubricants

Studies of the biodegradation of polymers

Polymer characterization

- Study of structure/property relationships

Cultural heritage research and preservation

- non-destructive testing of high quality surfaces



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Cooperation

From polymer to material

Our strength is many years of technical know-how in the material development of bio-based and biodegradable plastics

Development and compounding of thermoplastic polymers

- Extrusion, Injection molding
- Films
- thermoplastic foaming

Physical functionalization of bio-based polymers

- Blending, additivation
- Reactive processing and compatibilization in the melt

Processing and characterization

- Packaging
- Mulch films
- Semi-finished products

Behavior study of biodegradable plastics by aging and soil contact

Plastics testing



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Cooperation

From laboratory to industrial scale

We can provide sample quantities on an industrial scale.

compounding pilot plant

- Hot / cold mixer
- Laboratory press, laboratory mill
- Laboratory twin screw extruder
- Laboratory single screw extruder with connected flat and blown film units

Production Scale-Up

- Pilot and small batch production of compounds and products in industrial scale plants (400 kg/h)

Characterization of material samples and component testing

- Quality assurance
- Properties
- Structure



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