



Novel recyclable/reusable bioplastics in circular economy

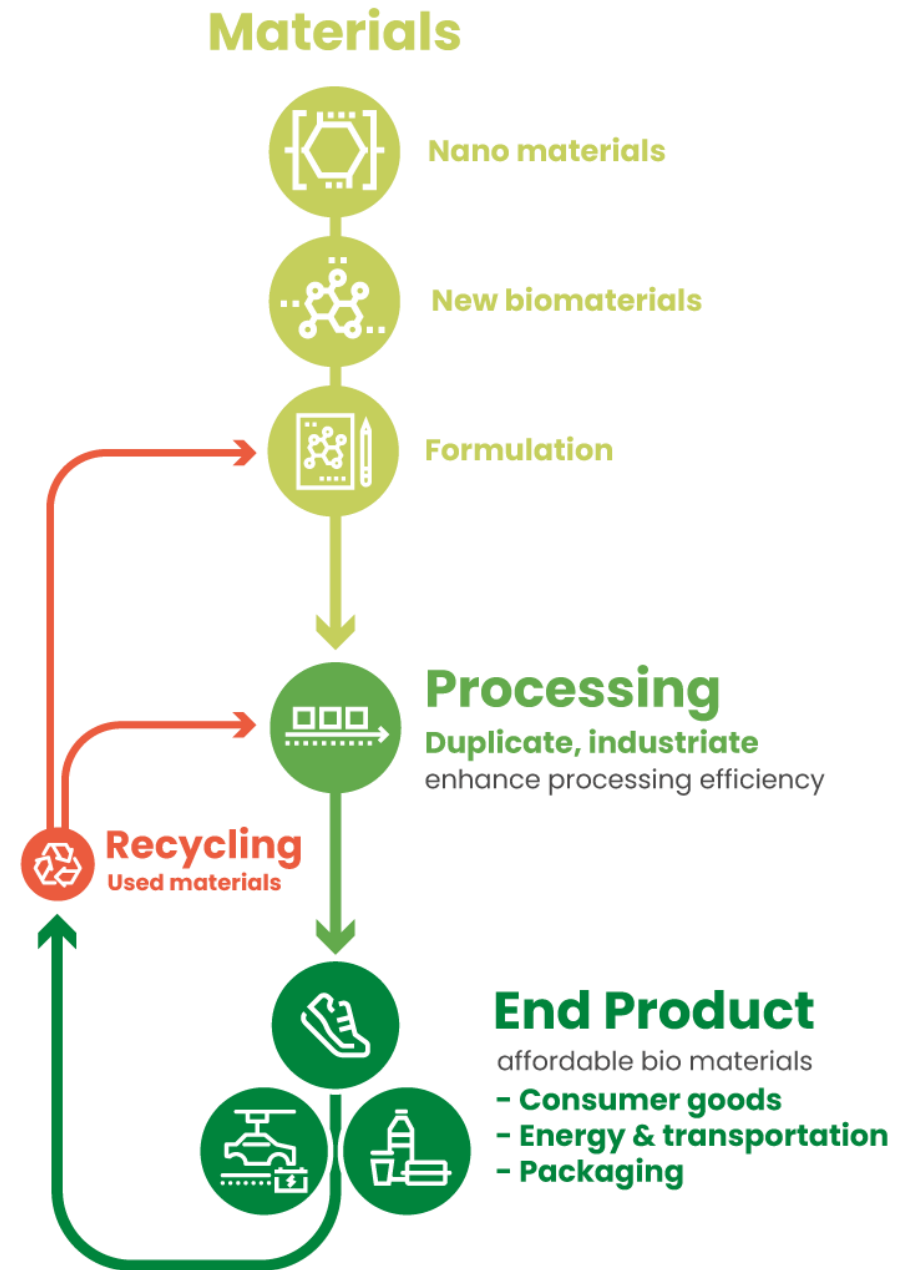
Plastic congress S³

Ulla Forsström, Principal Scientist at VTT Research
Centre Finland and coordinator of INN-PRESSME

23.3.2022

The Project

INN-PRESSME aims at
**developing & implementing a
sustainable Open Innovation
Test Bed (OITB)** to support
European companies to **scale
up their nano-enabled
biomaterials & processes** from
TRL 4-5 to 7



Facts & Figures

Developing materials & solutions for industry to replace fossil resources with sustainable, efficient, & cost-competitive bio-based materials.

Led by VTT from Finland



Ulla Forsström (coordinator)

www.inn-pressme.eu

European Union
H2020 Funding:

16.338.121,95 €



Start:

1st

January 2021

End:

31st

January 2025

49 months



Sustainable alternatives

The use of **bio-based materials** from biological sources (e.g. plants) as **sustainable alternatives** to fossil-based counterparts.

➤ 16 Pilot lines as open access services



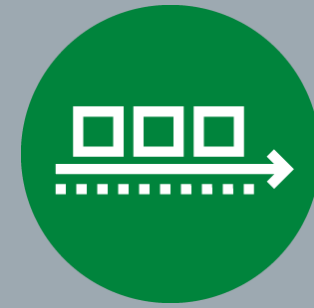
Nano-materials

Materials of which a single unit is small in size (in at least one dimension) – between 1 and 100 nm.



Bio-based Materials

Natural fibres /
Bioplastics, like starch-based PLAX /
Marine feedstock-based PHA
Ligno-cellulosic materials.



End-materials

INN-PRESSME aims to provide a network of pilots that cover the whole value chain, ensuring access to scale-up projects.

Test cases – validation of the 16 Pilot Lines

A set of **9 test-cases** will be used to validate the improved materials' performances & functionalities of the solutions developed by INN-PRESSME at real scale testing, & demonstrate the expected impacts, mainly those related to circularity.

Three Main applications fields



Packaging



Energy & Transport



Consumer Goods

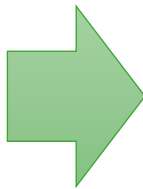


VTT 's Process Chemistry pilots → PLAX, etc

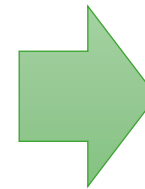
- Polymerization reactors for production of bio-based polymers
 - Reactors for preparation of polymer dispersions and formulations
 - Characterization of synthesized polymers and dispersions
 - Online measurements and data collection to support production, process control and results processing
- Scale-up possibilities for polymers and dispersions
 - Vacuum shovel reactors available from 10 L to 600 L
 - Temperature up to 200 °C
 - Vacuum up to 10-20 mbar
 - Ability to mix high viscous products



Lödige DVT 10



Drais TD 250 E



Lödige VTA 600

VTT 's Surface treatment pilot line SutCo

- Started in 2008, relocated 2021 VTT Bioruukki
- Horizontal bucket scale pilot up to 550 mm & 1...90 m/min
- Modular construction allows addition of tunable components
- Small coating/material demand for trials
- R2R materials: fibre-based materials, non-wovens or plastic webs
- Several pretreatment, coating and drying options



Converting, characterization, recyclability testing

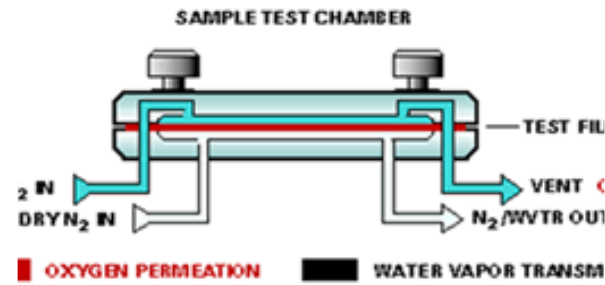
→ to be reusable in production of fibre-based packages

→ circular economy



Converting

- Speed
- Heat sealing temperature



WVTR/OTR Test

Characterization

- Barrier testing
- Strength properties
- Recyclability and Biodegradation



Product

- Filling
- Shelf life

To be collected with packaging materials and reused for production of corrugated board.

Polymaris Biotechnology: PHA Fermentation & Spray-drying



Current status for spray drying

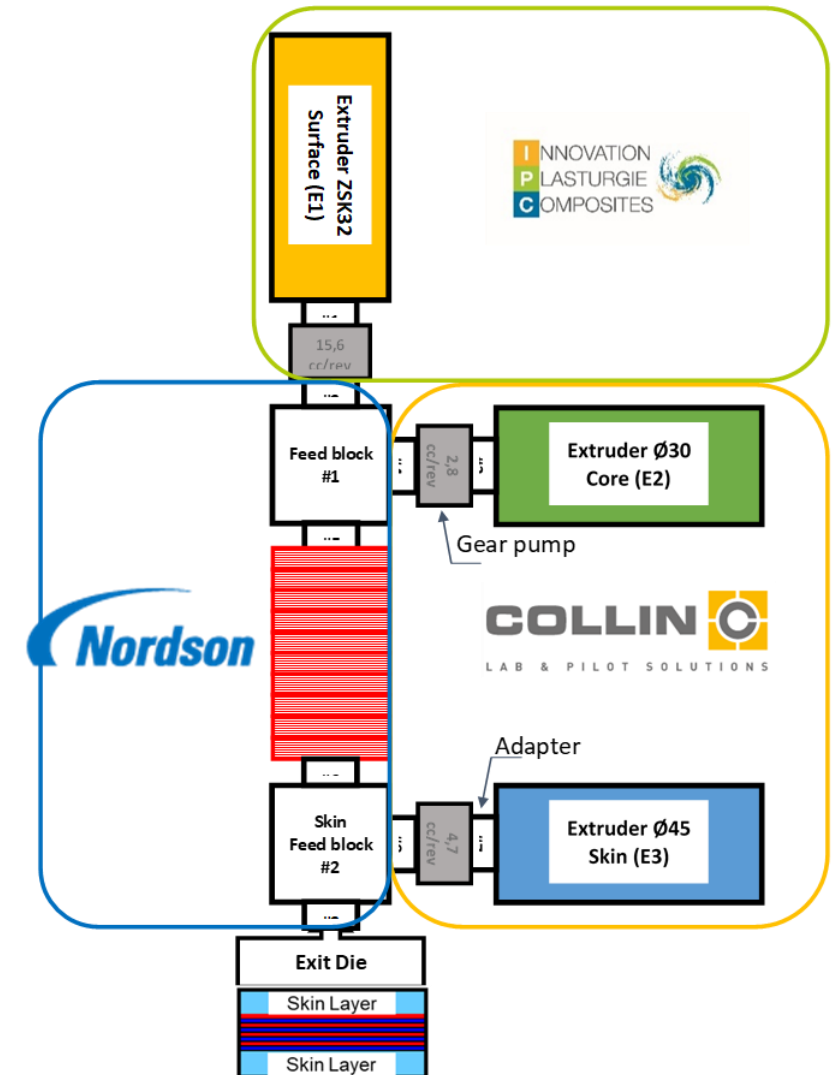
- Adjustment of parameters
 - Less humidity than before
- Better quality of powder
 - 50-60% to 85-90%
- Yield increase
 - 50-60% to 85-90%
- Better quantity of powder per hour

Next steps for spray drying will be

- Increase of the yield
- Automation of powder recovery



- Layer multiplying elements allow to increase the number of layers
- A single film with thousands of layers with nano-range thicknesses high gas barrier properties
- Multinano-layered Film extrusion of width up to 600 mm & thicknesses from 50-100 µm:
 - Nordson LMT technology and flat die
 - 750 mm width and deckling system
 - And chill-roll
 - Roll diameter 250 mm & width 800 mm
 - Speed 1-50 m/min



Biobased tubes for cosmetics (IPC)

The new environmentally friendly design – recyclable in production of fibre-based packages or as plastic composites – will be **3 laminated layers**:

- an **outer bio-based plastic film**
- a **central paper** sheet
- and an **inner multi-nanolayered mono-material film** providing gas barrier properties
- To be **recycled and material used** as fibre-based packages or plastic composites
- With good **gas barrier properties**
- With highly **aesthetic** packaging (self-cleaning, gloss effect,..)

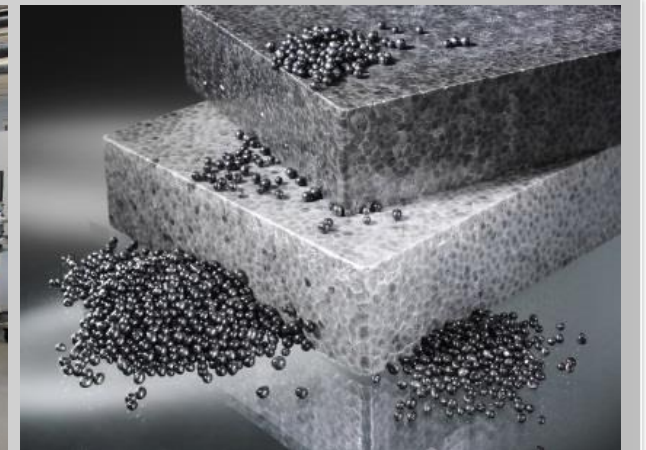


FhG-ICT Foam extrusion for beads/packaging

Pilot line consists of 3 main process technologies for the development of biobased particle foams (PLA & PHA):

- Particle foam extrusion incl. underwater pelletized
- Steam based pre-foamer
- Steam-chest moulding machine to produce reusable and recyclable biobased packaging solution

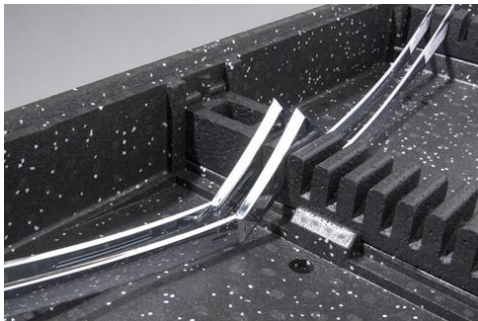
**Particle
foaming**



Demonstrator - reusable bio-based boxes



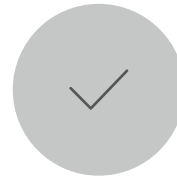
- Bio-based reinforced particle foams are tested in a steam chest moulding process to produce logistic boxes in an industrial environment
- Resulting materials will be characterised, focusing on the crucial properties of the product: mechanical performance, density, shock absorption, and abrasion resistance
- Mechanical recycling of bioplastics



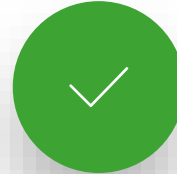
Other OITB services

Designing products to be more sustainable, assessing life cycle & life cycle costs, testing recyclability & biodegradability, studying nanosafety

Lead partner  **AIMPLAS**



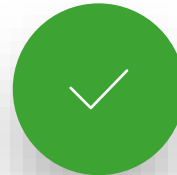
Improve the sustainability by following eco-design approaches



Life cycle assessment (LCA) to identify & analyse the environmental aspects & impacts



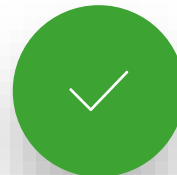
Cost evaluation, for wider implications of technology selection



Analysing mechanical recycling or organic recycling of test cases



Ensure & guarantee nanosafety for all the developed products



Produce a specific Roadmap to define the end of life (EoL) options of all products

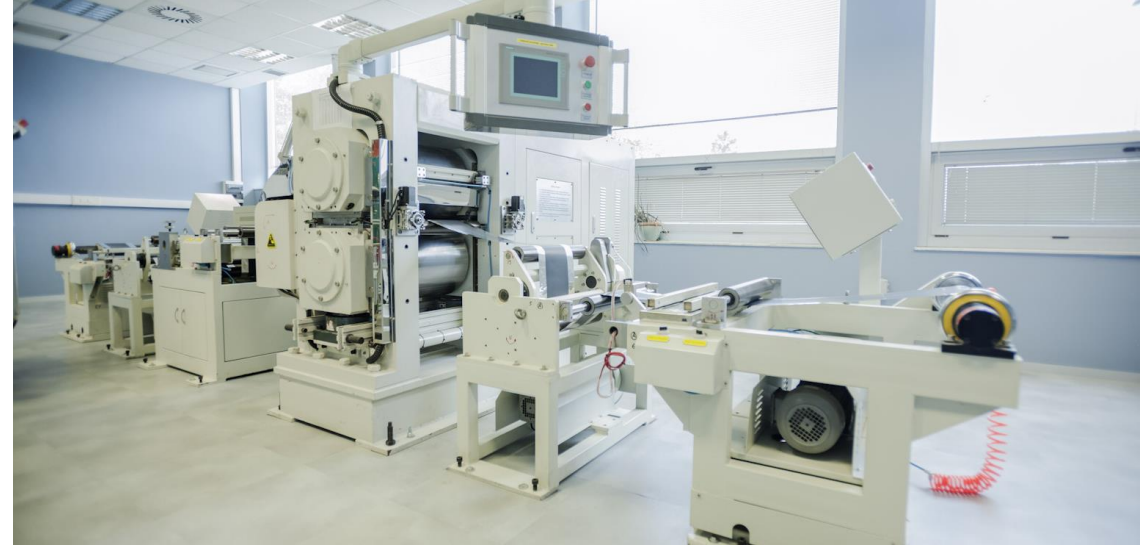


Scaling up services in 2023 through open calls

Open call opens in Fall 2022.....



Open Innovation Test Bed



- Developing, testing & **upscaling of nanotechnology** & advanced materials in industrial environments
- Bringing **nanotechnologies & materials** from validation in a laboratory (TRL 4) to **prototypes** in industrial environments (**TRL 7**)

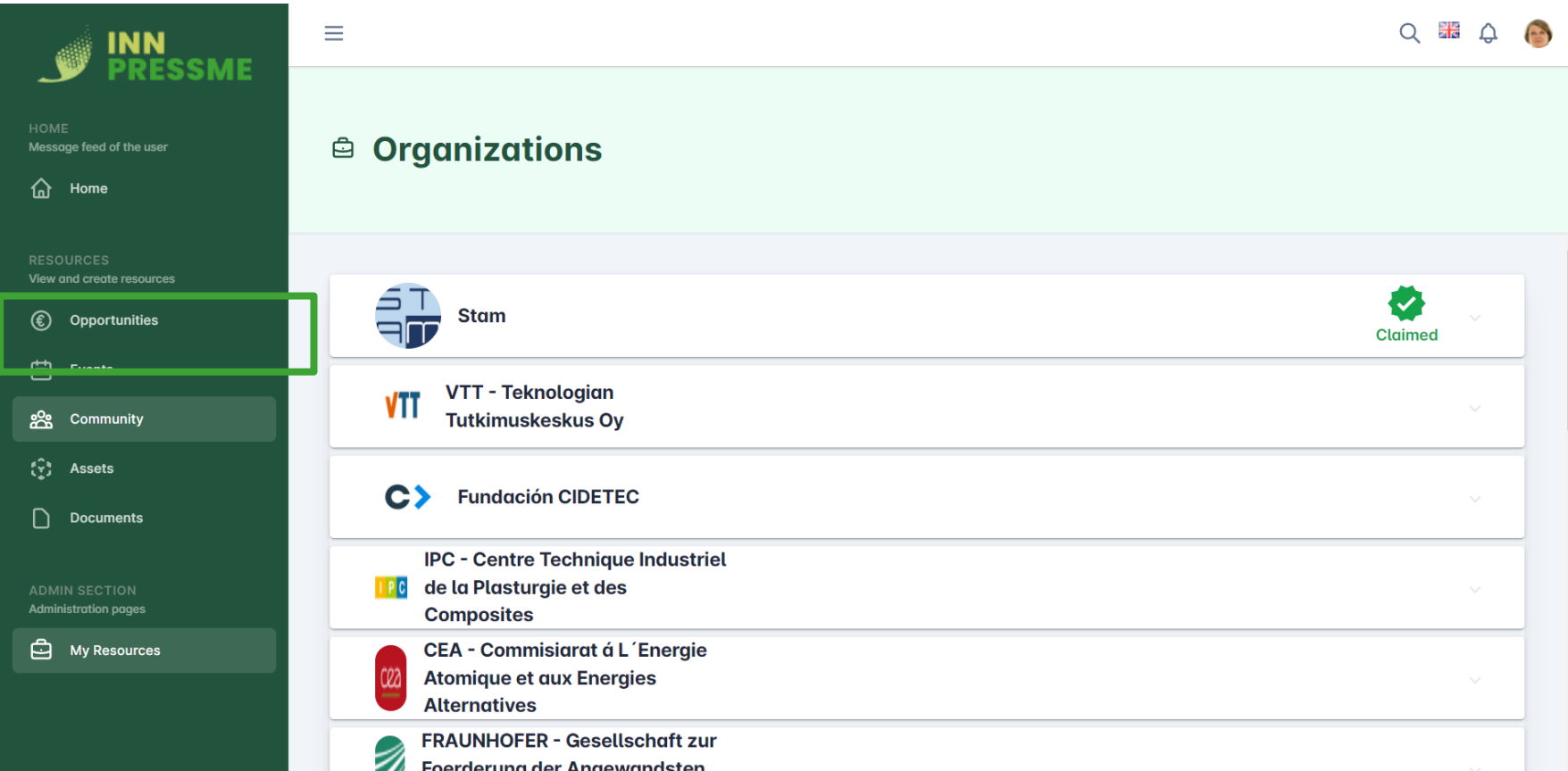
- **Upgrading** existing / supporting setting of new public & private **test beds, pilot lines & demonstrators**

- **- Open calls for additional partners starting in 2023**

- Managed by **Single Entry Point (SEP)** rules to be defined along 2022

- Supporting companies in developing & testing novel nano-enabled biomaterials
- Up to **15-18 companies** may receive subsidised access to the INN-PRESSME OITB piloting services
- **1.6 M € overall budget for the validation with new test cases**
- Call is open mainly for SMEs and industrial partners targeting for packaging, energy/transport and other consumer products
- Eligible countries: EU Member States & associated countries
- Open from Autumn 2022 to Autumn 2023 and applicants can apply anytime through our Digital Platform
- Submitted proposals will be evaluated, first deadline in January 2023

Services applied through opportunities



A **Digital Platform** has been developed to manage project assets (pilot lines, services, etc.) It will be adapted to manage:

- the **Open Calls**, during the project
- the **interactions between the SEP, service providers and customers**, after the end of the project

From Lab to Industry to Market





Thank you!

Contact

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