SUPSI

Sustainable educational toys, and plastics for zero emission

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University of Applied Sciences and Arts of Southern Switzerland
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Summary

- A short introduction of the Polymer Engineering Laboratory
- The project ξύ (*xi*): a sustainable material
- Plastic for ZERO Emission Innovation Booster

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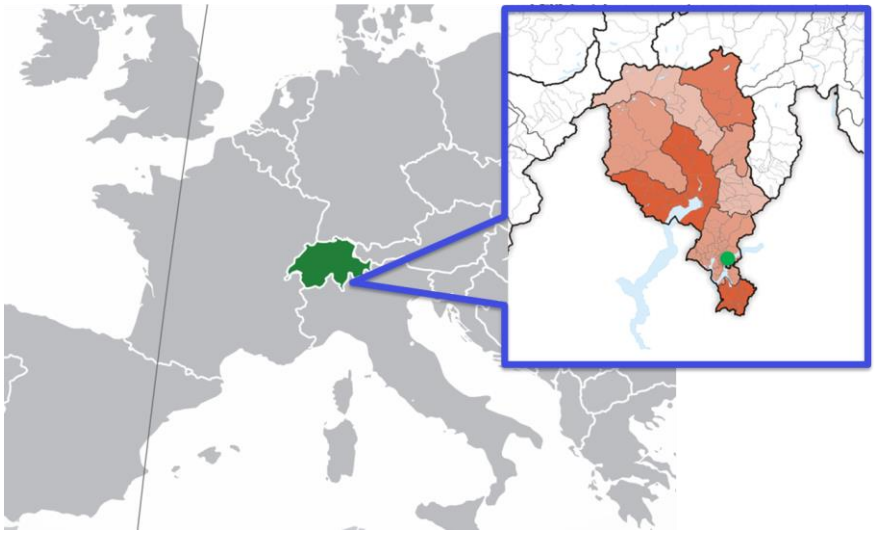
Polymer Engineering Lab

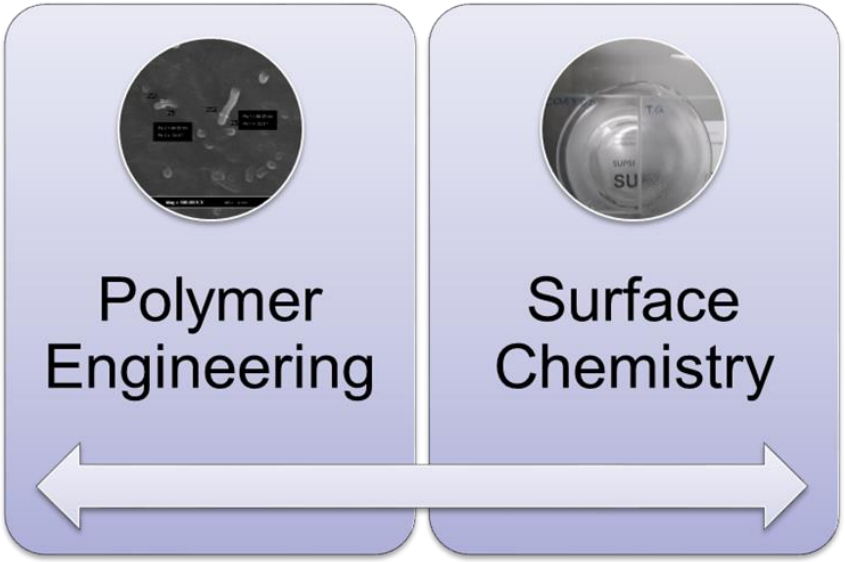
Institute of Mechanical Engineering and Materials Technology (MEMTI)

Department of Innovative Technologies (DTI)

University of Applied Sciences and Arts of Southern Switzerland



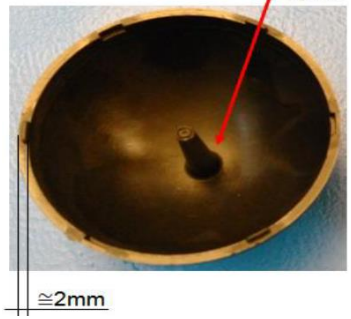
Polymer Engineering Lab



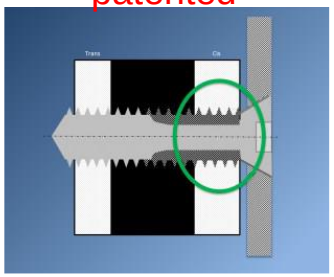
Applied R&D pillars:

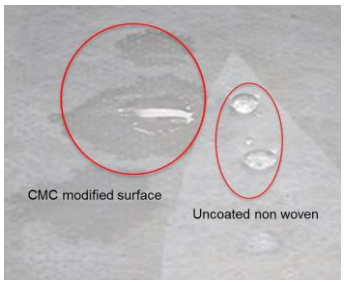
- polymer / composite engineering
- functional nano-coating based on waterborne polymeric solutions

patented



patented



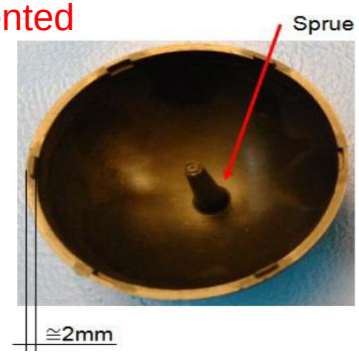


Polymer Engineering Lab

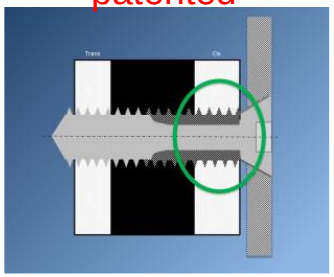
TOPICS

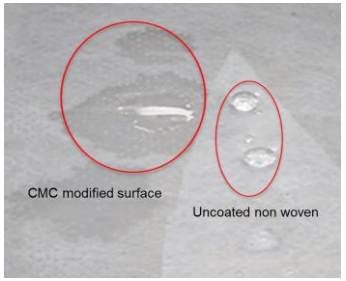
- polymer degradations and stabilisation
- flame retardancy
- thermal/electro/magnetic properties
- tailor-made compounds
- polymer for biomedical application

patented



patented





Polymer Engineering Lab

Innosuisse & Mandate: In the last 5 we have been managing R&D projects for a value of more than 6'500'000.- CHF:

Project Name	Code	Years
Sistema con auto-apprendimento per la ricerca automatica di fibre di amianto tramite microscopia a scansione elettronica	Innosuisse 103.819 IP-ICT	2023-2024
Fluorine-free "layer by layer" nanocoating for a new generation of omniphobic textiles	Innosuisse 55540.1 IP-ENG	2022-2023
A new generation of drug-eluting wound dressings with tunable release kinetics of combinations of active compounds through layer-by-layer nanoassembly	Innosuisse 46183.1 IP-LS	2020-2021
Nanocoating idrofobo e senza fluoro per sci	Innocheque 48160.1 INNO-ENG	2021-2021
XI	**Innosuisse 47891.1 IP-ENG**	**2020-2021**
Layer by layer technology for the prevention of microbiological growth on immovable Cultural Heritage	SUPSI Strategic R&D Funding	2020
Modeling and Amelioration of micronization process in spiral jet mills controlling the Caking pHenomenon **Ind. Partner: JET PHARMA**	Innosuisse 37766.1 IP-ENG	2019-2022
Layer by Layer nano-assembly approach for manufacturing hydrophilic nonwoven for surgical drapes **Ind Partner: EXTEN SA**	Innosuisse 32557.1 IP-ENG	2019-2020

The Polymer Engineering Laboratory staff

Andrea Castrovinci, PhD	Professor – Head of IMP
Anna Rita De Corso, Master	Senior Researcher – Nanocoating
Marco Spaggiari, Master	Researcher – Polymer engineering
Alessandro De Carolis, Master	Researcher – Specialist
Lizeth Betancourt	Researcher Assistant
Gabriele Campi	Assistant (MSE student)
Marco Selva	Assistant (MSE student)

The team counts on highly qualified researchers. The working experiences span from 6 up to 20 years on R&D in the academia and private sector.

Polymer Engineering Lab Partners (a selection of):

Hint Labs

coim

GEOMAG™

GIOTTO industrial networking

EXTEN films, laminates and sheets

GALVOLUX Tecnica del vetro e dello specchio

SIP swiss Industrial Promotion sa

Innovative Recycling

Click in the LOGOs to follow the links

Polymer Engineering Lab Partners (a selection of):

swiss plastics cluster

COMPOSITES UNITED | SWITZERLAND

PLASTICS FOR ZERO EMISSION

Innovation Booster powered by Innosuisse

Summary

- A short introduction of the Polymer Engineering Laboratory
- The project ξύ (*xi*): a sustainable material
- Plastic for ZERO Emission Innovation Booster

The project ξύ (xi): a sustainable material

University of Applied Sciences and Arts of Southern Switzerland

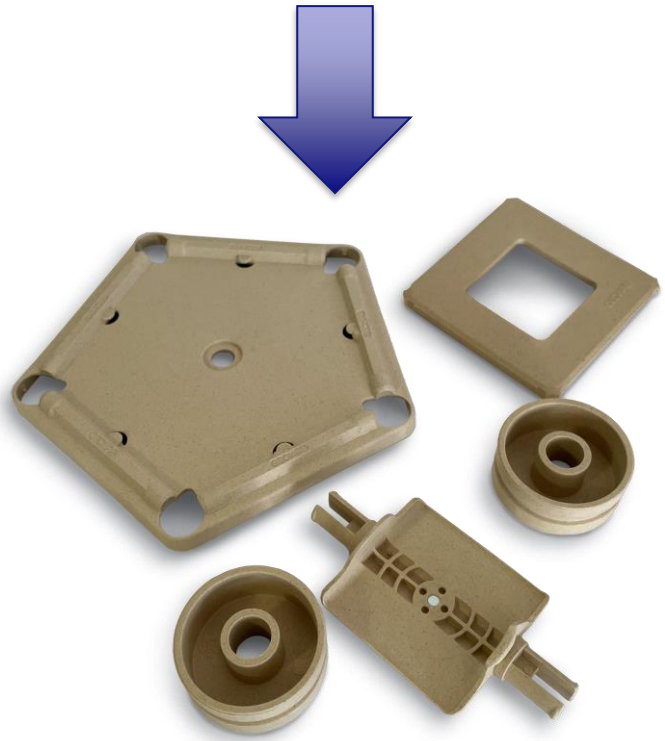
SUPSI

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Innosuisse – Swiss Innovation Agency

GEOMAG™



The project ξύ (xi): a sustainable material

Background of the project: GEOMAG needs

- GEOMAG “[…] responsible for the future of the environment that we are living in, […] we run a responsible and sustainable business.”
- The premium toys market is very reactive to more sustainable products

The project ξύ (xi): a sustainable material

Background of the project: GEOMAG needs

- GEOMAG wanted to develop polymer compounds from sustainable raw materials:
  - Recycled polymers
  - Waste woods
  - Renewable additives
  - EN70 compliance

University of Applied Sciences and Arts of Southern Switzerland

SUPSI

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

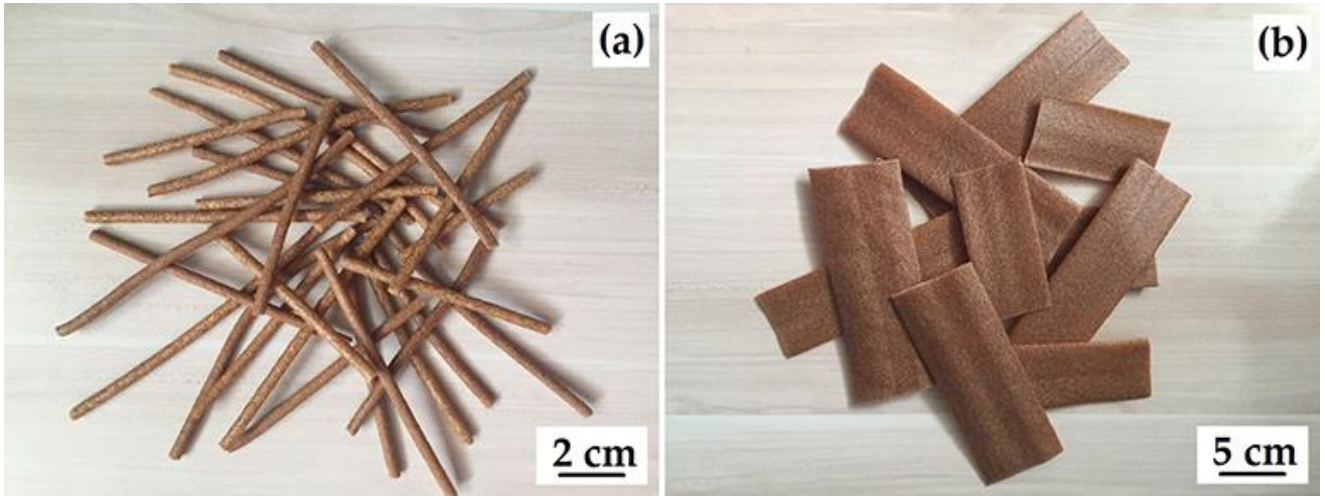
Swiss Confederation

Innosuisse – Swiss Innovation Agency

The project ξύ (xi): a sustainable material

What are the challenges / What is Innovative?

Wood compounds are not new nor innovative *di per se*



Picture from: Wood-Reinforced Polymer Composites, Anil Akdogan and Ali Serdar Vanli In Wood in Civil Engineering, Ed. Giovanna Concu, 2017, ISBN 978-953-51-2986-8

The project ξύ (xi): a sustainable material

What are the challenges / What is Innovative?

Compliancy with EN70 having a exploitable material:

- Recycled Polypropylene matrix (impurities, quality variability)
- Waste woods as raw material (impurities, quality variability)
- No Processing Aids / Compatibilizers (e.g. maleic grafted PP)

- MAX filler load vs Preserving good processability
- MAX filler load vs Excellent mechanical properties
- MAX filler load vs Excellent touch and feel features
- MAX filler load vs Aesthetic features

The project ξύ (xi): a sustainable material

What are the challenges / What is Innovative?

- MAX filler load vs Preserving good processability

Prodotto/Progetto	Miscela: XI02M / Progetto XI					Data	[redacted]
Operatore/i	Marco Spaggiari						
Consegna (kg)	12						

Componenti	$\rho_{app.}$ [g/l]	Dosatore	$P_{det.}$ [kg/h]	Posizione	wt%	kg	Lotto
[redacted]	534	[redacted]	[redacted]	BM	[redacted]	[redacted]	n/a
[redacted]	169	[redacted]	[redacted]	SF	[redacted]	[redacted]	n/a

Legenda dosatori: DO1 = dosatore 1; DO2 = dosatore 2; DO3 = dosatore 3.
Legenda Posizione: BM = bocca macchina; SF = side feeder.

Estrusione: ora inizio: 9:45 ora fine: 14:15 Tempo tra rilevamenti successivi: circa 3

		UM	SET	VALORI EFFETTIVI (rilevamenti) I	II	III	IV	V
Essiccazione	NO	°C	-	-	-	-	-	-
	NO	h	-	-	-	-	-	-
Pre-riscaldamento	NO	°C	-	-	-	-	-	-
	NO	h	-	-	-	-	-	-
Dosaggio	Portata	kg/h	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	DO1	kg/h	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	DO2	kg/h	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	DO3	kg/h	-	-	-	-	-	-
Temperature / pressione	Z1	°C	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Z2	°C	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Z3	°C	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Z4	°C	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Z5	°C	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Z6	°C	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Z7	°C	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Z8	°C	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Melt	°C		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		bar		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Estrusore	VP	rpm	400	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		A %		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	SF	rpm	200	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Dosatori	DO1	%		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	DO2	%		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	DO3	%		-	-	-	-	-

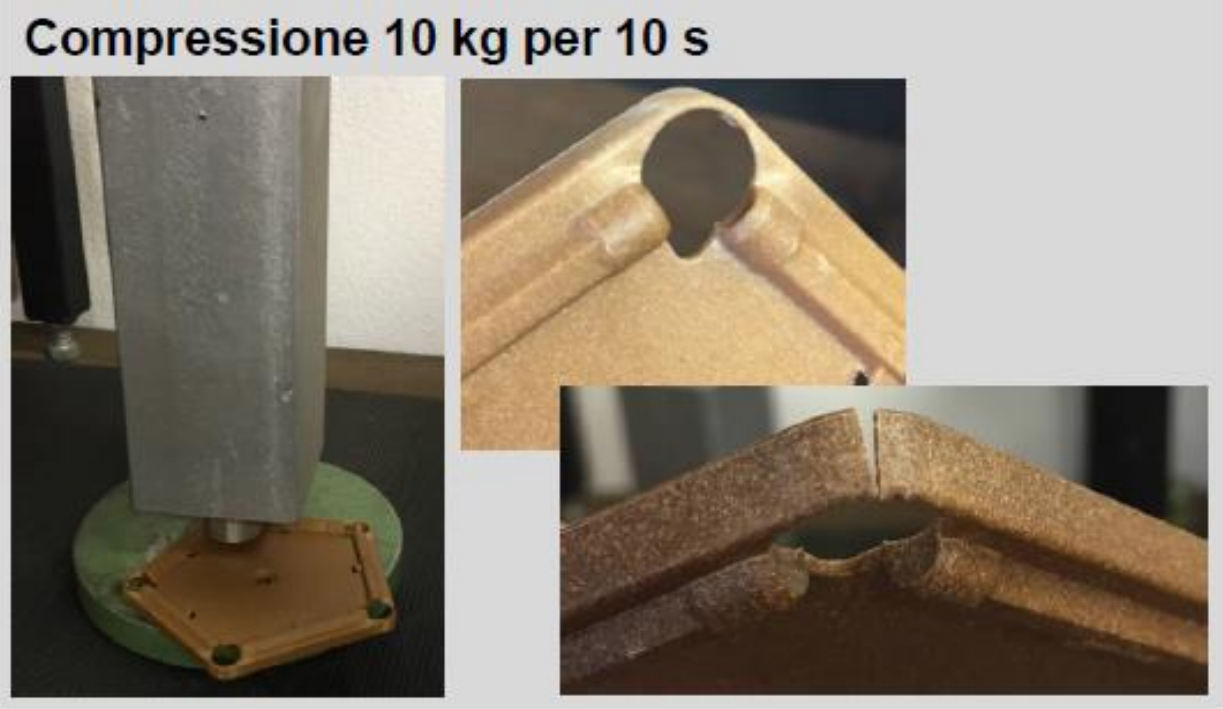
Legenda: VP = vite principale; SF = side feeder; rpm = rotazioni al minuto; A = assorbimento.

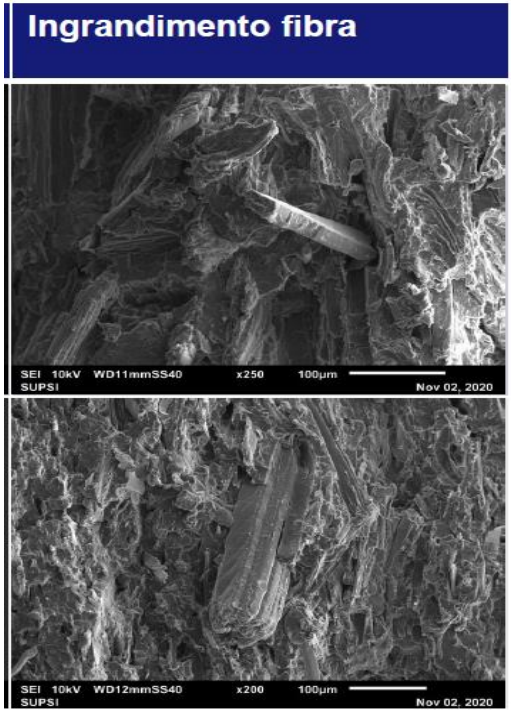
Vuoto	ON	-	ON	-
	OFF	-	-	-
Trituratore	Cilindro traino	rpm	[redacted]	[redacted]
	Taglio (motore)	rpm	[redacted]	[redacted]
Post-essiccazione SUPSI	SI	°C	[redacted]	[redacted]
	SI	h	[redacted]	[redacted]

The project ξύ (xi): a sustainable material

What are the challenges / What is Innovative?

- MAX filler load vs Excellent mechanical properties





The project ξύ (xi): a sustainable material

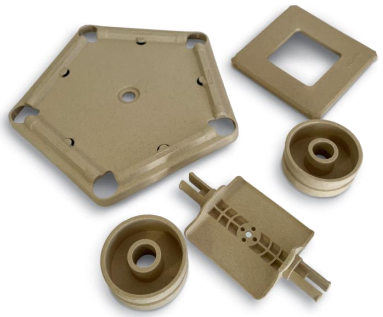
What are the challenges / What is Innovative?

- MAX filler load vs Excellent touch and feel features
- MAX filler load vs Aesthetic features

The project ξύ (xi): a sustainable material

What we achieved?

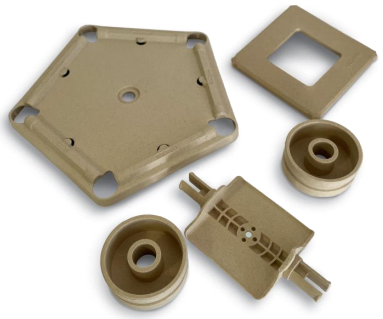
- A new class of polymeric compounds EN70 certified:
  - Recycled polymer matrix
  - Waste wood filled
  - Renewable additives (e.g. processing aids / compatibilizers)



The project ξύ (xi): a sustainable material

How…

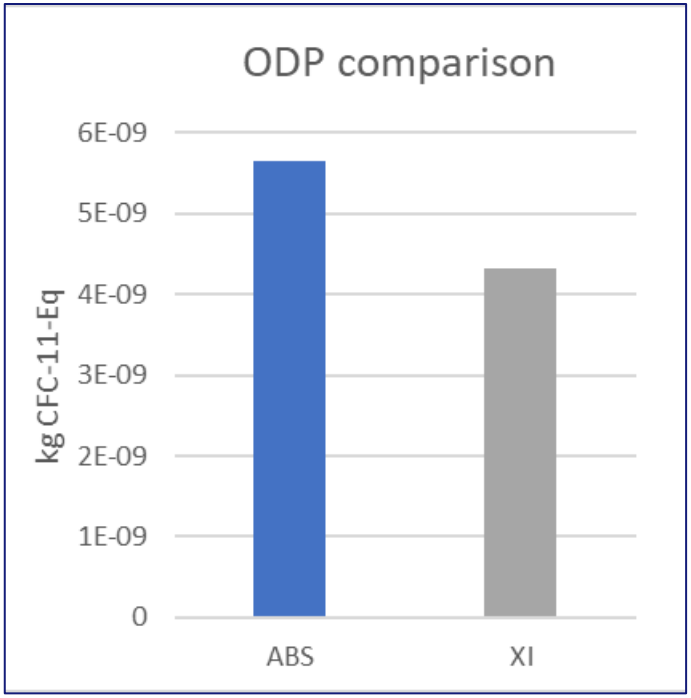
- A close control on the raw material (e.g. waste wood supply chain)
- An in deep understating of the process VS fillers/additives VS material microstructure VS material properties
- A sustainable alternative to SoA processing aids and compatibilizer



The project ξύ (xi): a sustainable material

What we achieved?

- An LCA* perspective



*NOTE: LCA has been performed by Laura Bauce and Alessandro Fontana
Sustainable Production Systems Laboratory
Institute of Systems and Technologies for Sustainable Production
Department of Innovative Technologies

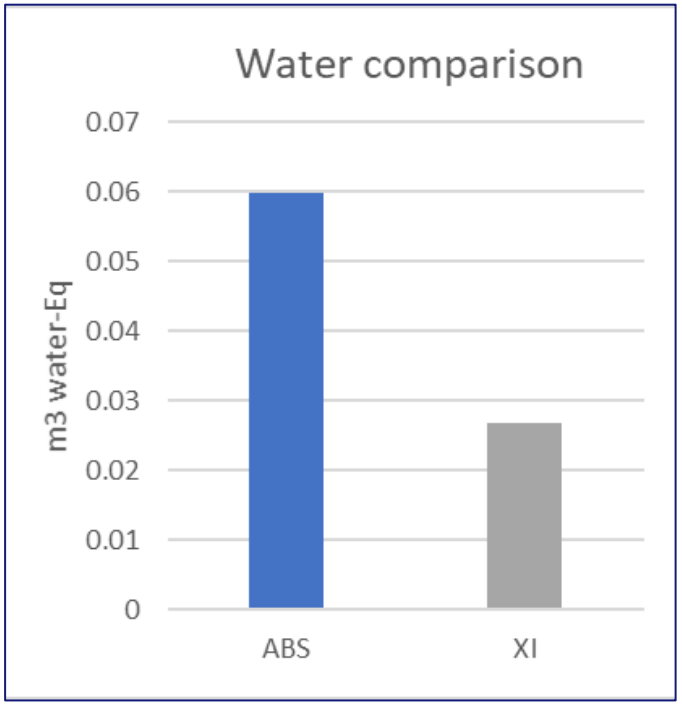
University of Applied Sciences and Arts of Southern Switzerland

- Ozone Depletion Potential (ODP) expressed as kg R11 eq.

The project ξύ (xi): a sustainable material

What we achieved?

- An LCA* perspective



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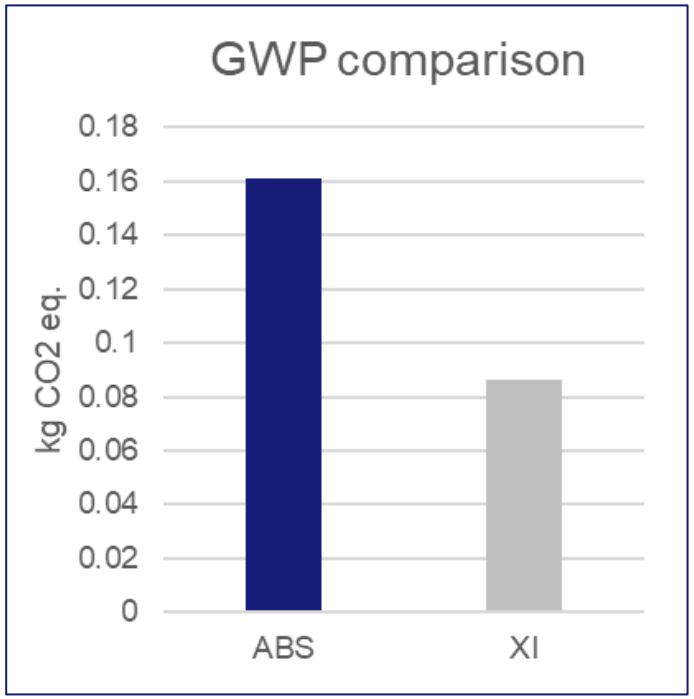
- Dissipated Water expressed as m3 water eq.

The project ξύ (xi): a sustainable material

What we achieved?

- An LCA* perspective



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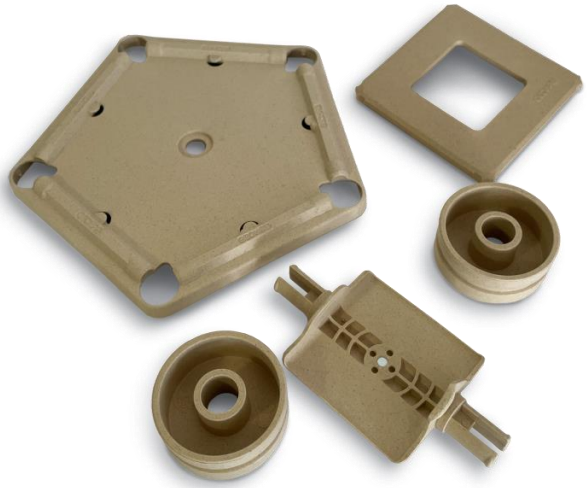
- Global Warming Potential (GWP) expressed as kg CO2 eq.

The project ξύ (xi): a sustainable material

Next Steps:

- Patent Pending
- Exploring other applications



Summary

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- The project ξύ (*xi*): a sustainable material
- Plastic for ZERO Emission Innovation Booster

PLASTICS FOR ZERO EMISSION

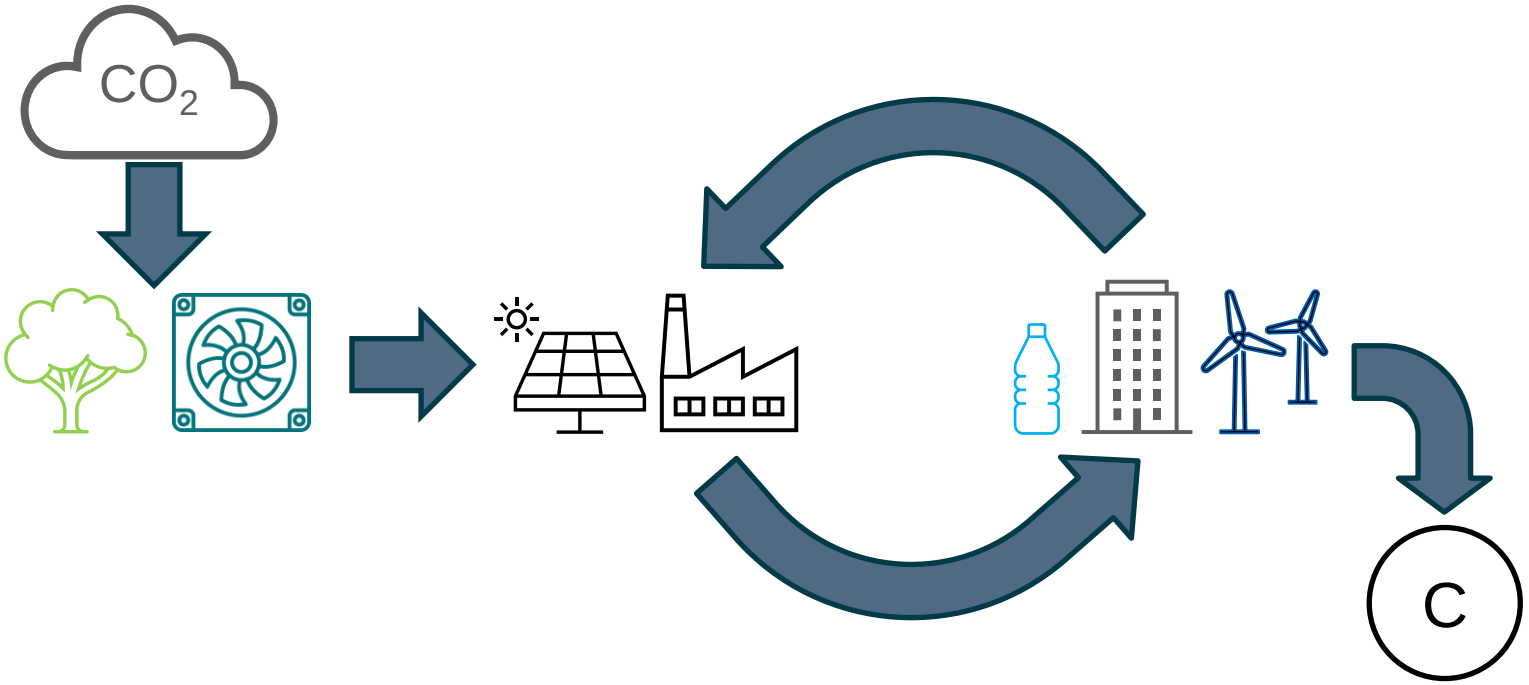
Innovation Booster
powered by Innosuisse

2 February 2023

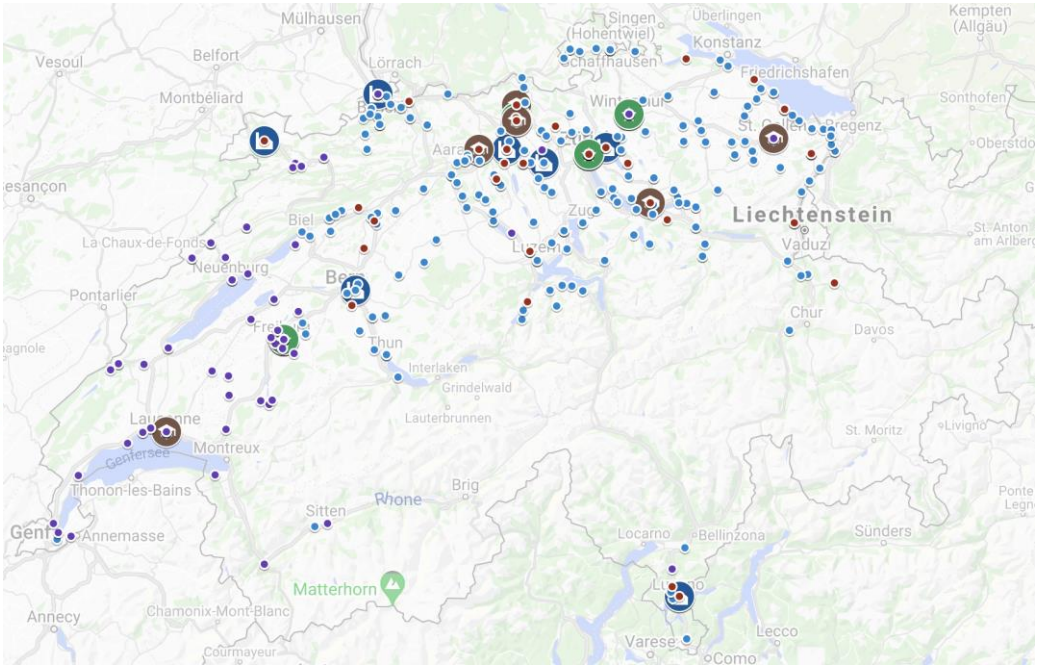
INNOVATION BOOSTER
PLASTICS FOR ZERO EMISSION

- Financed by Innosuisse for 2022 to 2025
- Two calls for projects per year
- 10 projects financed per year
- Seed money CHF 25’000 (plus 2’500 co-funding) per project
- Methodical support, events and networking support as integral part of the Innovation Booster
- Leading House: Composites United Switzerland

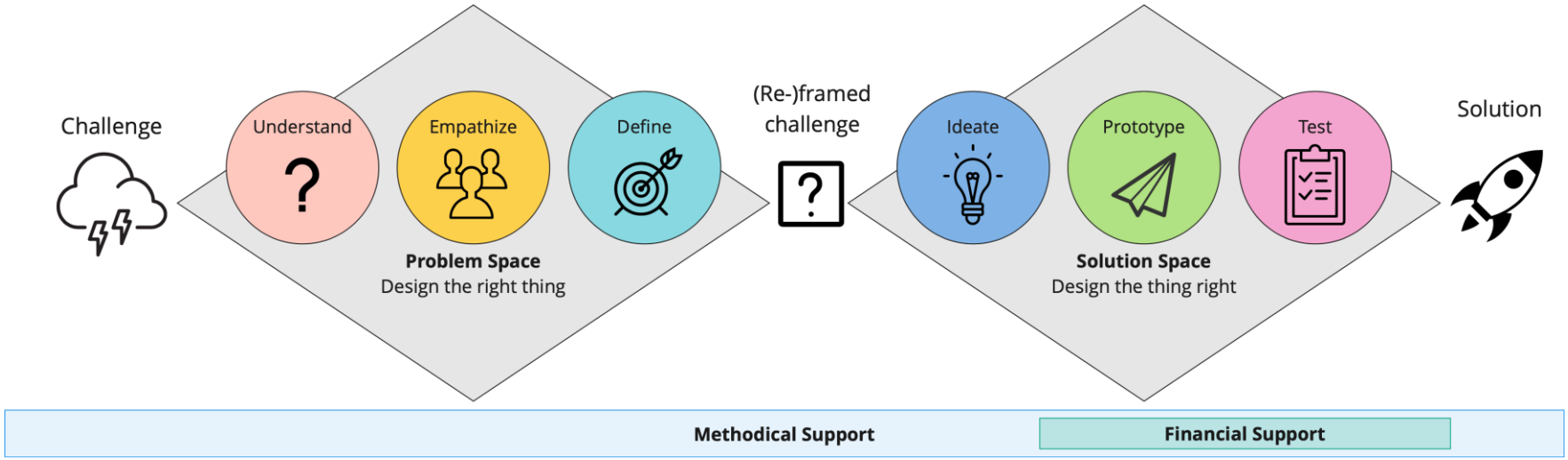
FROM CLIMATE-NEUTRAL PRODUCTION TO NEGATIVE EMISSION MATERIALS



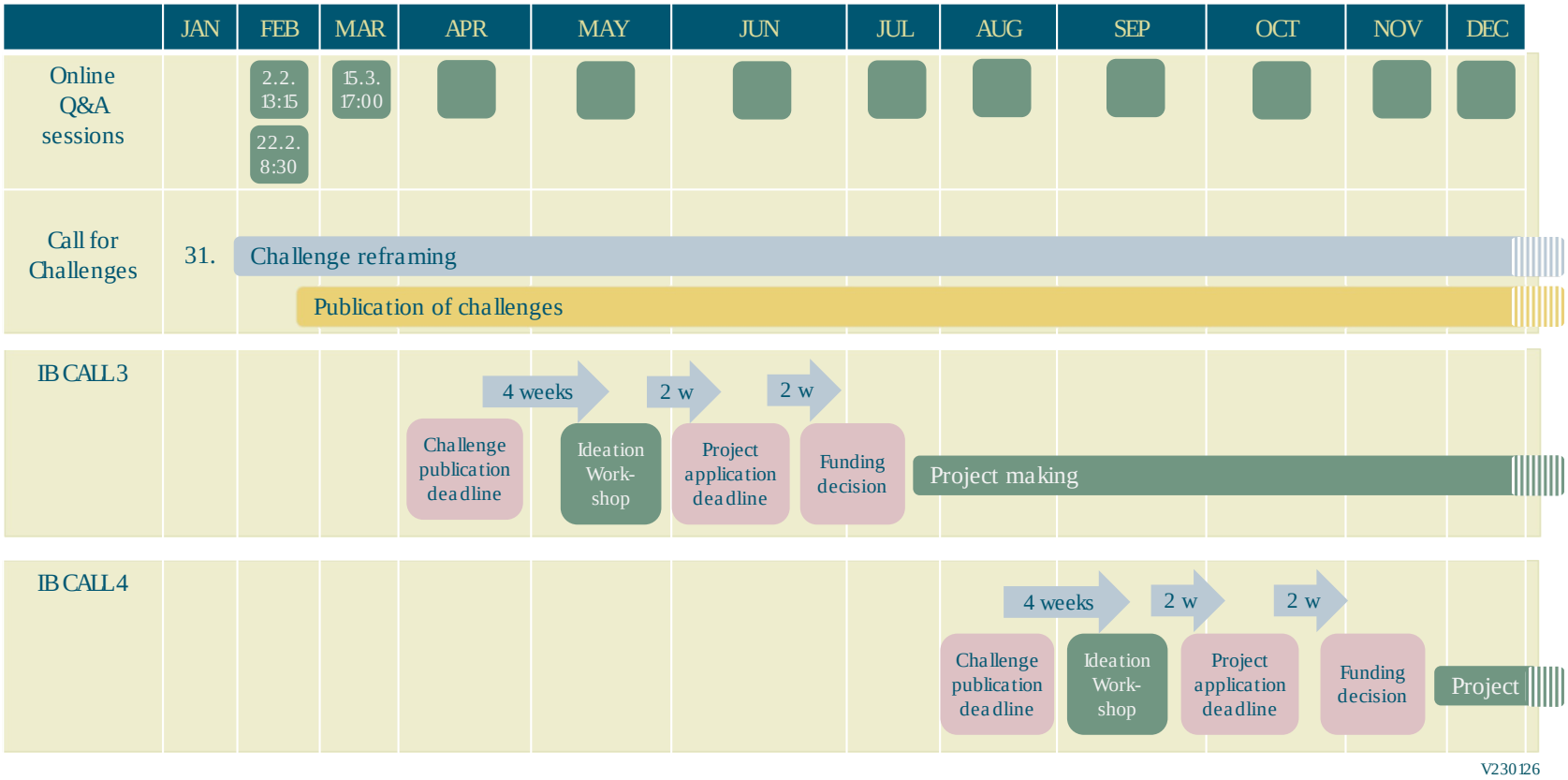
CONSORTIUM AND COMMUNITY OF INTEREST



OUR INNOVATION BOOSTER PROCESS



SCHEDULE 2023



V230126

INVOLVEMENT OF IMPLEMENTATION PARTNER

- Financial contribution (only if project is funded)
  - CHF 2500 to the project
  - CHF 2500 to the Innovation Booster Plastics for Zero Emission Leading House
- Implementation partner needs to be a Swiss organisation and/or projects needs to add socio-economic value for Switzerland
- Seed money cannot be used to cover internal costs of implementation partner
- Sufficient time needs to be allocated to participate in design thinking process and workshops

PROJECT REQUIREMENTS

- At least one research partner and one implementation partner
- Evaluation criteria for granting seed money:
  - Thematic focus
  - Degree of innovation
  - Effect (Including CO2 reduction potential)
  - Methodical quality
  - Gender and diversity
- Participation in workshops and annual conference
- Methodical support in prototype/test phase has to be paid from seed money (tbc)

QUESTIONS?

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Latest updates and newsletter subscription

https://plastics4zeroemission.ch

Contacts

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Thank you for your kind attention