waste2 biocomp

PHBV microparticles in PHBV matrixes. Palstic production produced by extrusion and injection molding

How to do it?

Application

Author: Anja Schmidt

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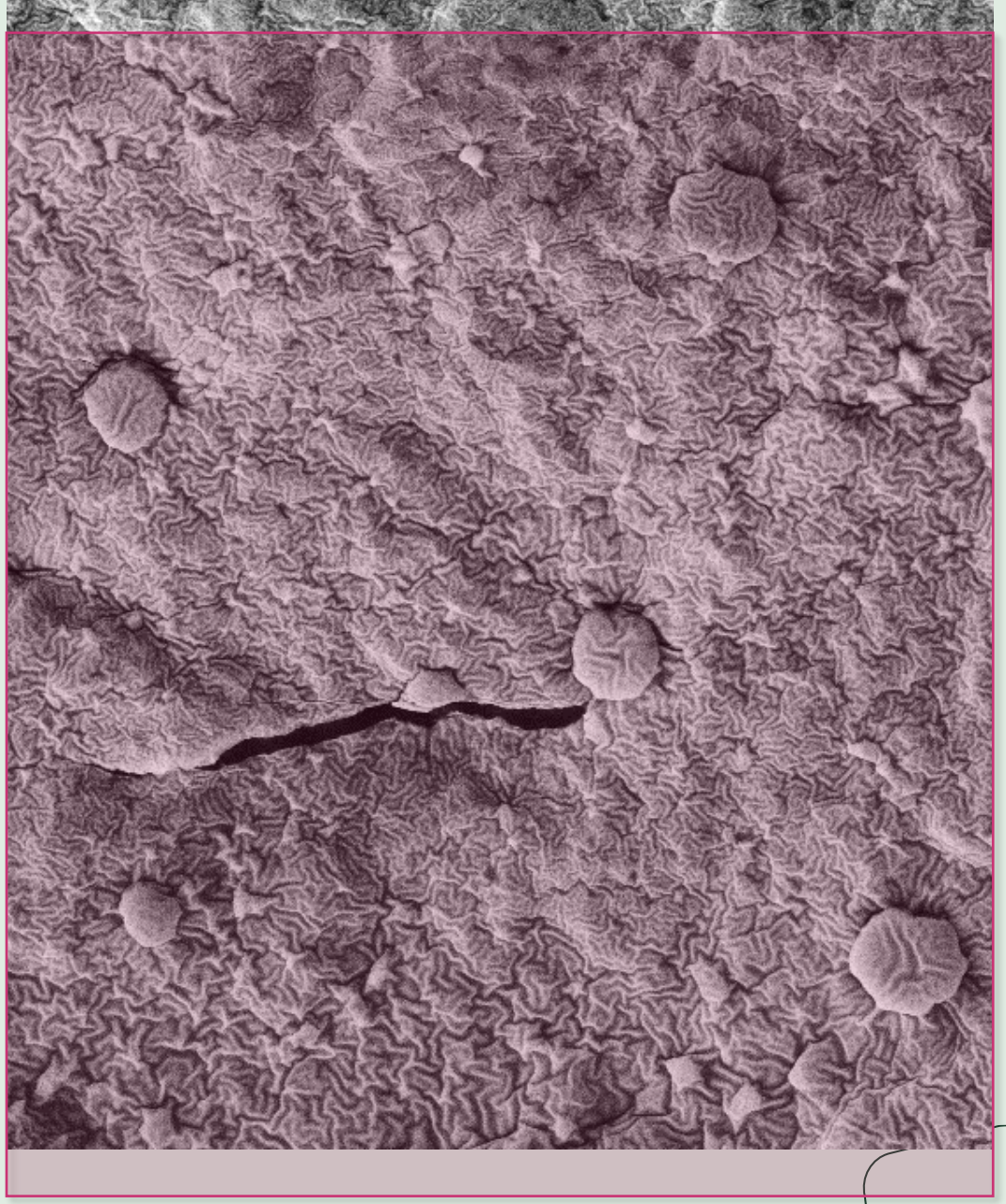
Funded by the European Union

PHBV microparticles embebed in PHBV matrixes produced by extrusion and injection molding how to do it?



- Dipl. Ing. Anja Schmidt
- Grupo de Polímeros
- Universidade da Coruña

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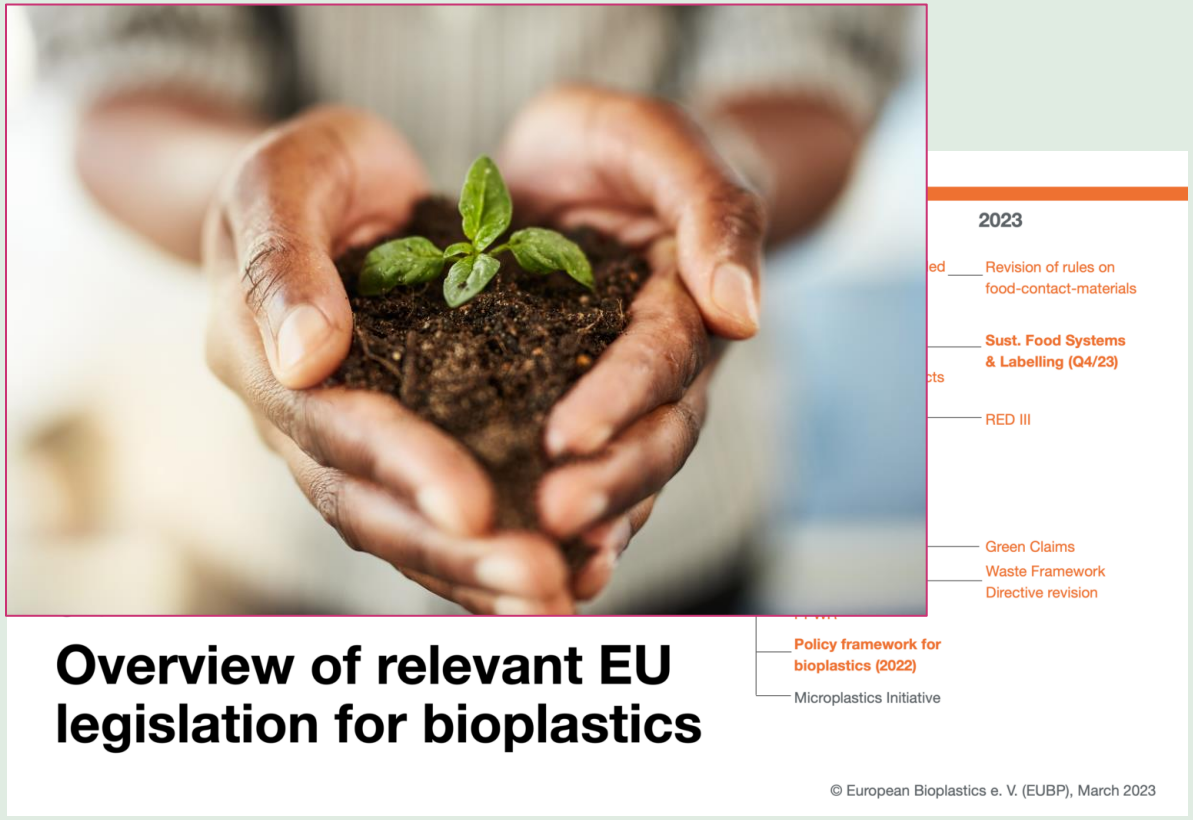
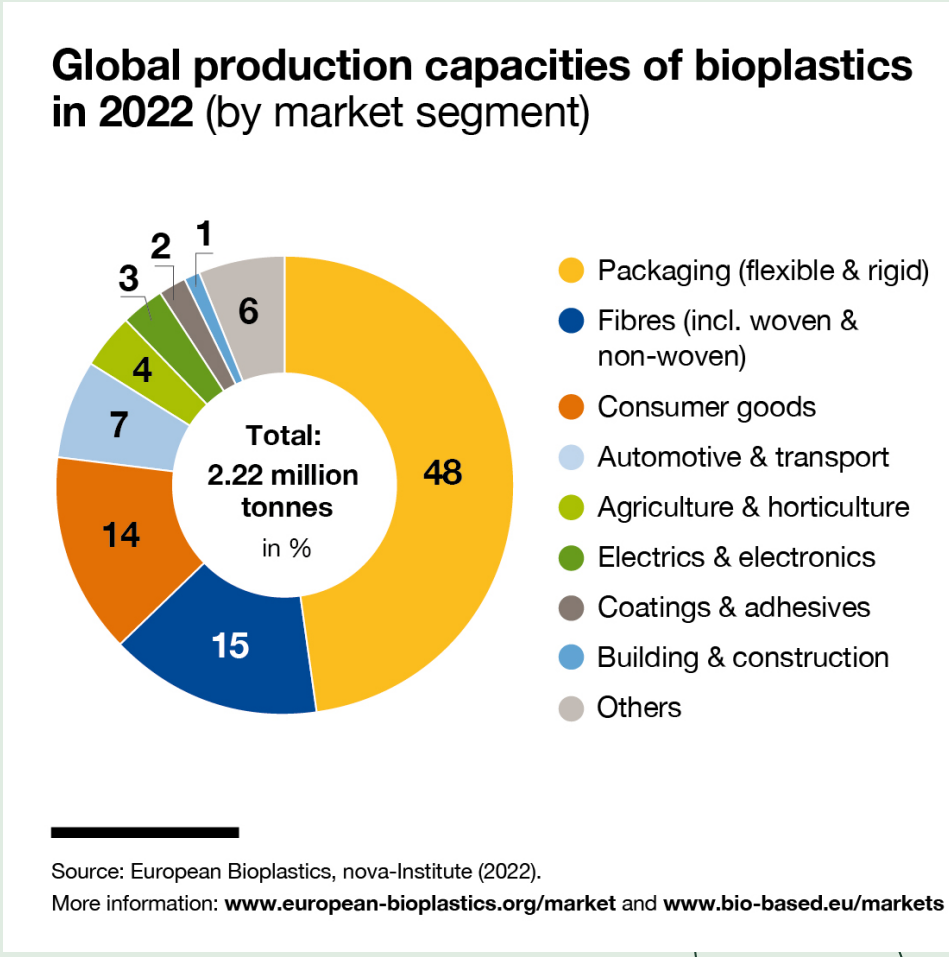
Introduction





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Motivation

Objective

- completly biobased and biodegradable particle reinforced composite
- applications in the packaging industry

Innovation

- by pre-industrial melt processing (before just laboratory scale solvent-evaporation)

Future potential

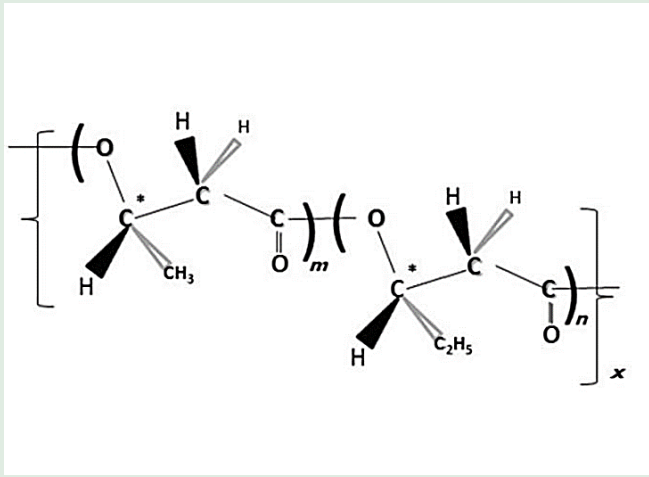
- Possibility in future of loaded microparticles with active substances

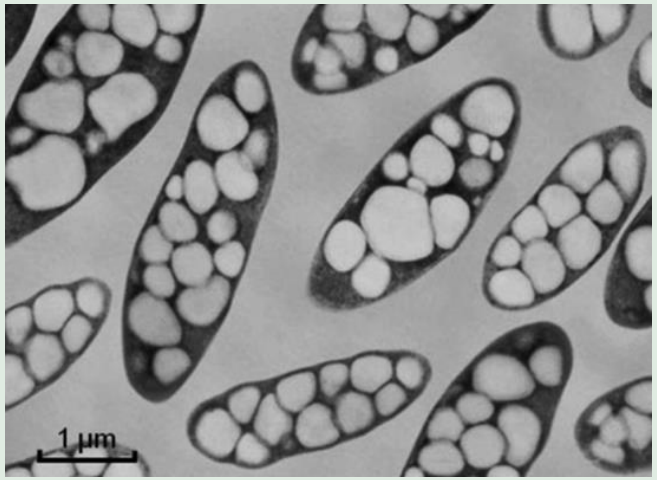
Materials

Polyhydroxybutyratevalerate (PHBV)

- Polyhydroxyalkanoate
- Biobased (by biosynthesis in microorganisms)
- Biodegradable (microbial fermentation)

- Properties
- Good processing properties
- Mechanical properties depending on hydroxyvalerate (HV) content
- Good barrier properties

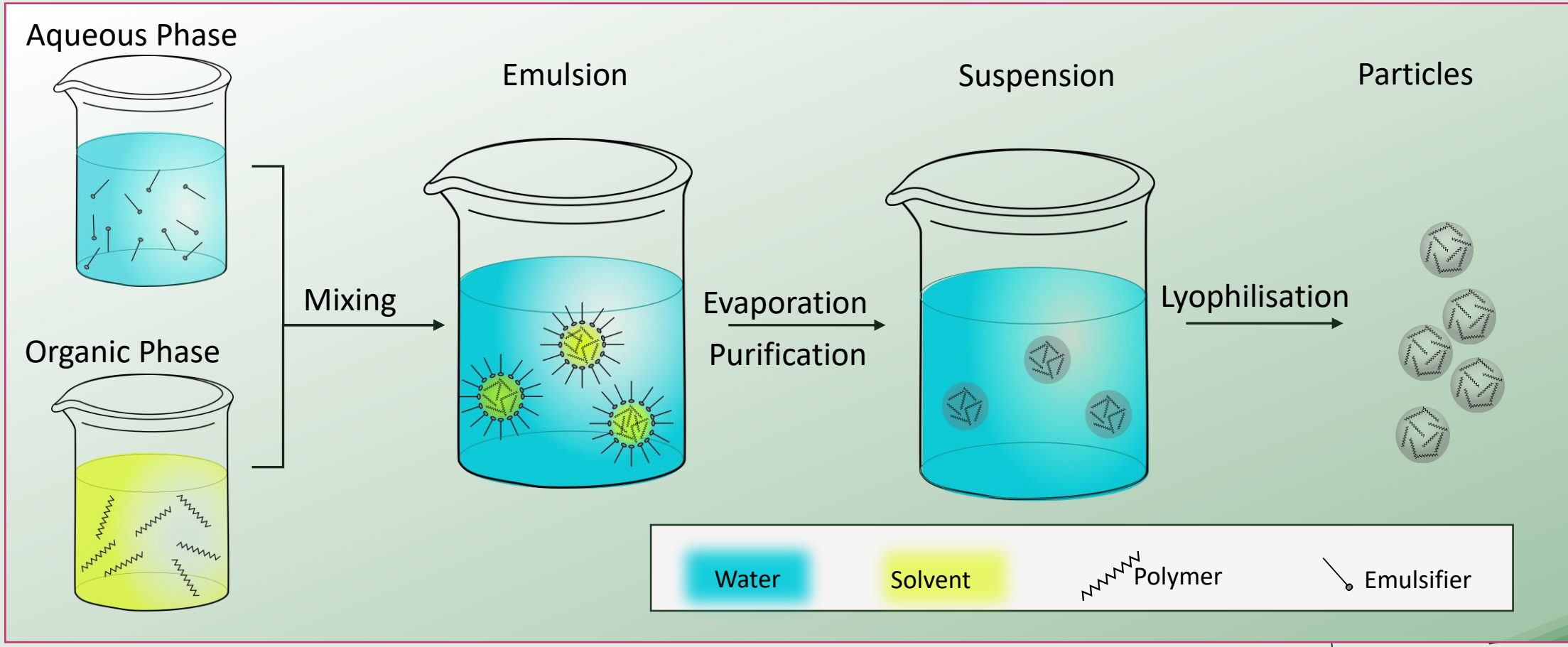




- Applications
  - Packaging e.g. shampoo bottles
  - Agricultural (mulch films)
  - Medical (skeleton tissue regeneration)

Methods

Microparticles via Miniemulsion-Evaporation-Technique



Methods

Biocomposites via miniextrusion and miniinjection

Haake Force Feeder Minilab II

- Distribution and Dispersion of the particles in the matrix

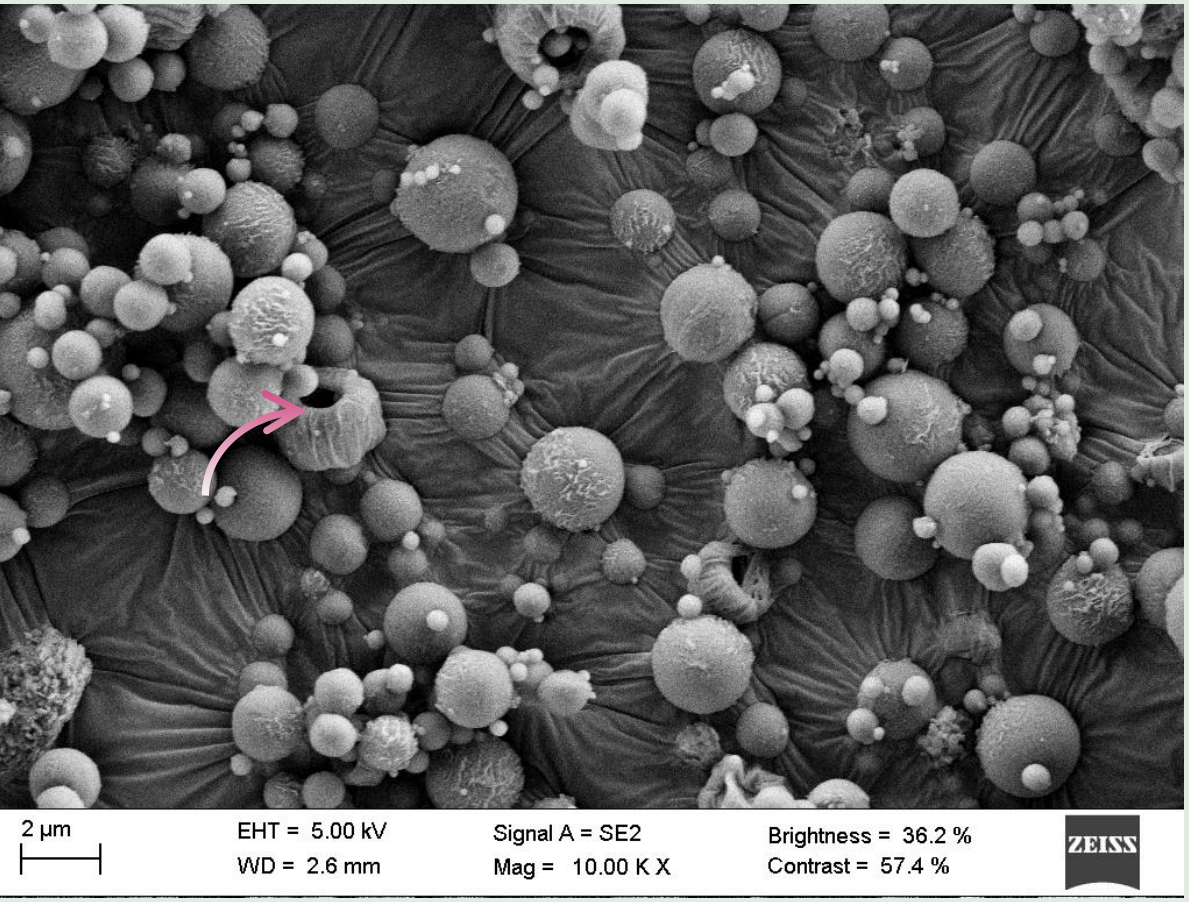
Thermo Scientific HAAKE MiniJet II

- Molding of tensile test specimens

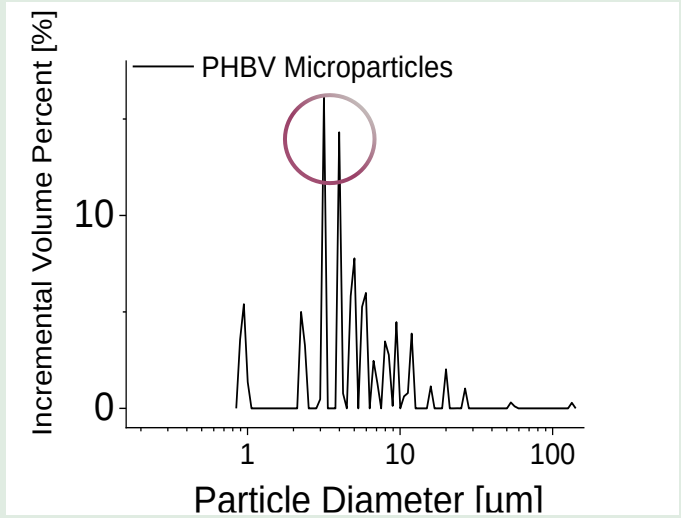
PHBV Biocomposites with 1, 3, and 5wt.% PHBV Microparticles

Results

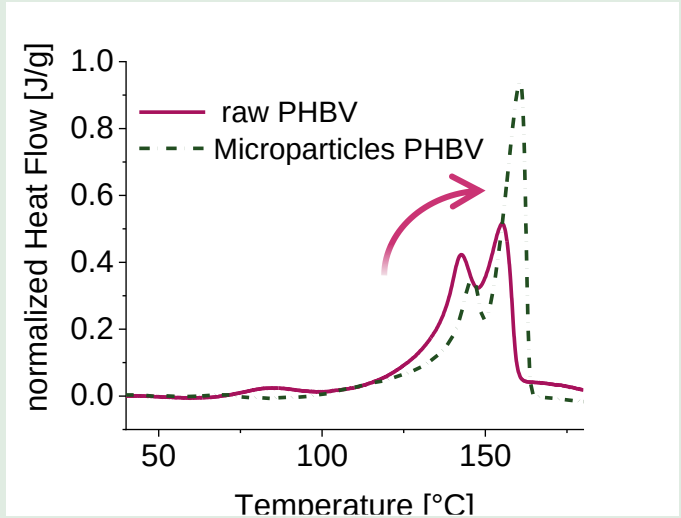
Microparticles



SEM Images of PHBV MIcroparticles



Size distribution by SLD

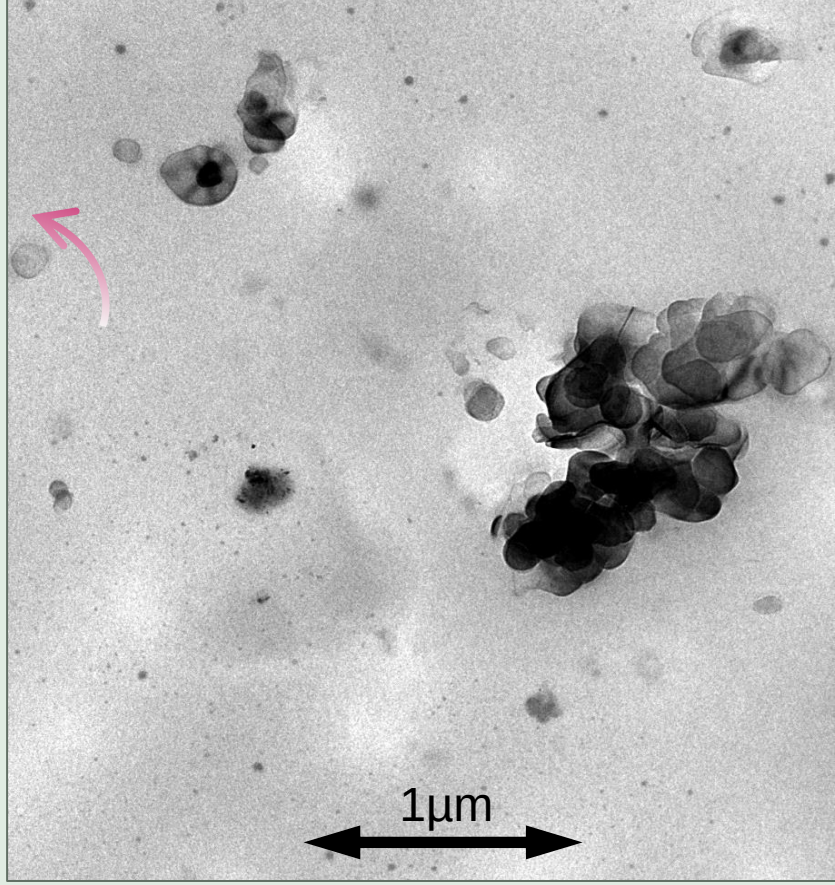


Melting behaviour and crystallinity by 1.Heating DSC Scan

Results

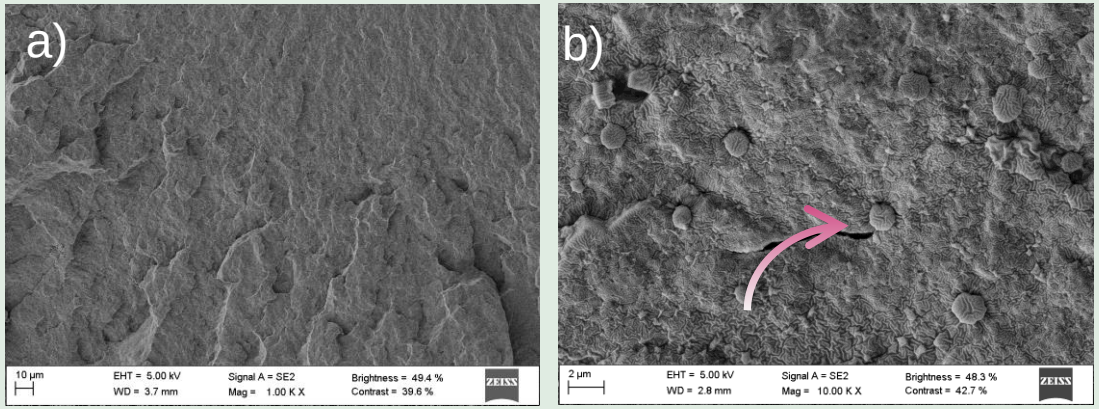
Particle self-reinforced Biocomposites

Do the microparticles survive the melting process?

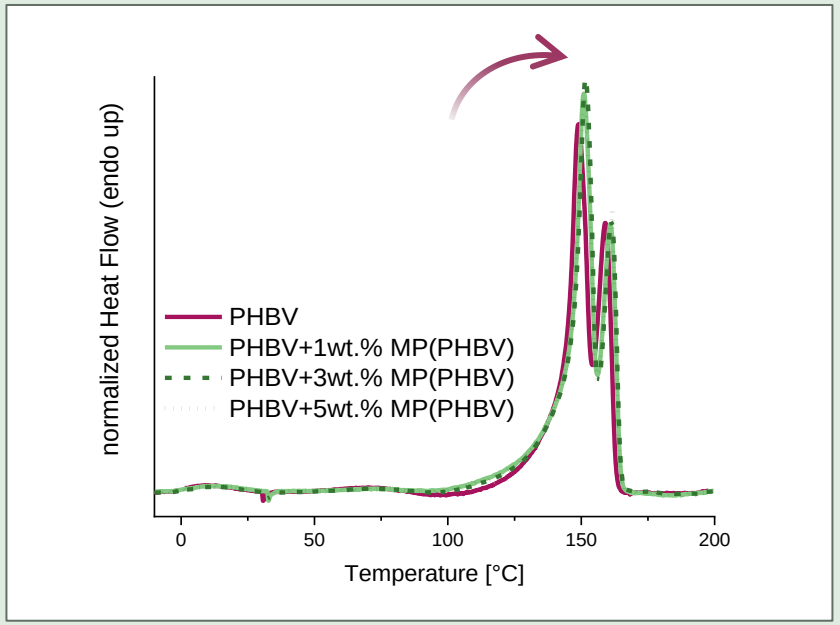


TEM Image of PHBV +5wt% MP(PHBV)

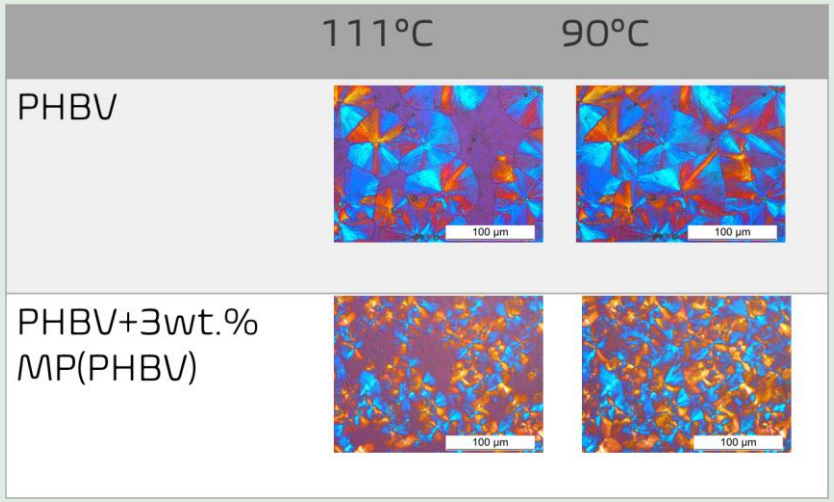
SEM Images of a) PHBV and b) PHBV +5wt.% MP(PHBV)



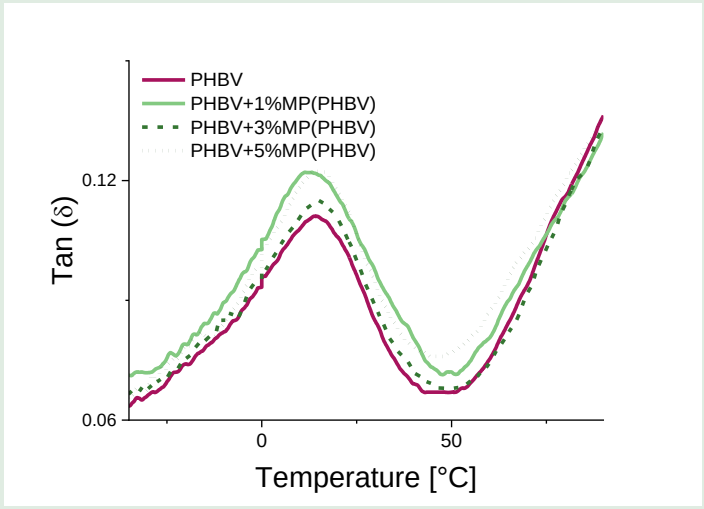
How does the microparticles influences the thermal properties?



Thermal properties: DSC Scan of 2.Heating



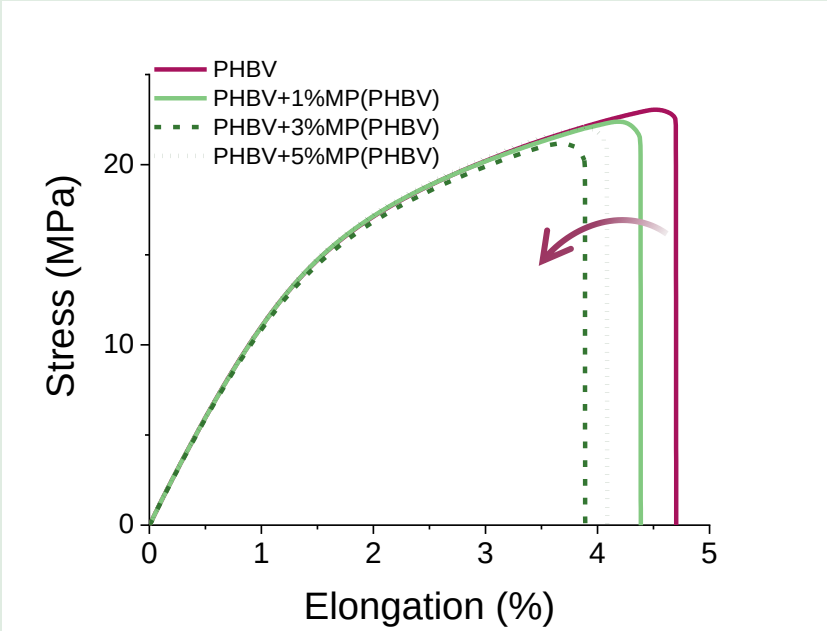
POM Images:from melt to crystallization



Graph of Tan(δ) by Dynamical Mechanical Analysis

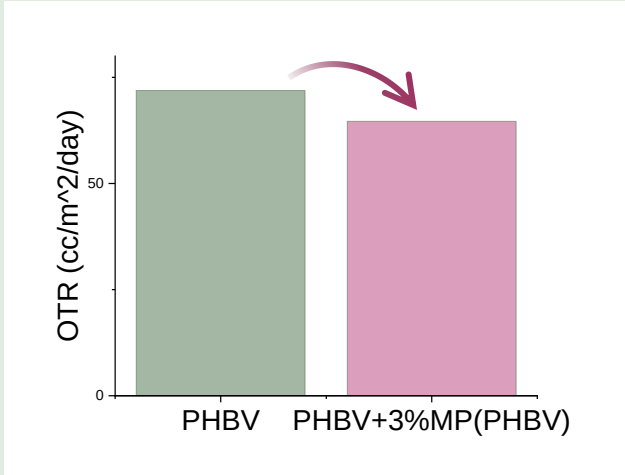
→ Microparticles as nucleating agent

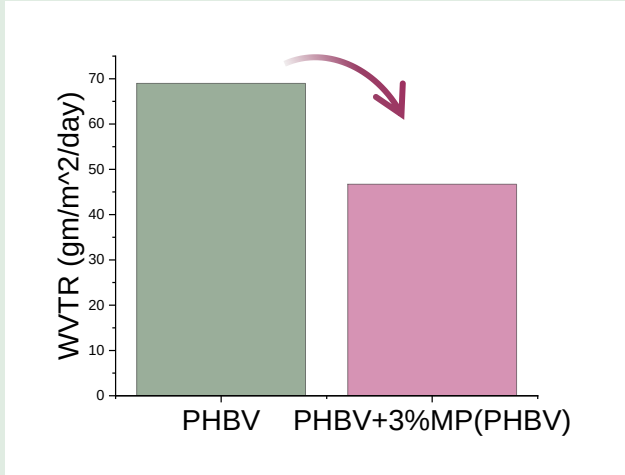
How does the microparticles influences the mechanical properties?



Stress-strain-diagramms of tensile test

Barrier properties to Oxygen and Water Vapor

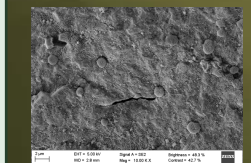


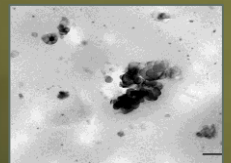


→ Changes in the application properties

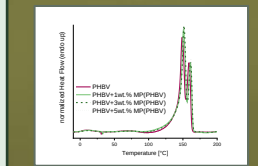
Summary

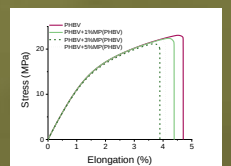
- ✓ Producing of Biocomposites by melt processing is possible
- ✓ Small microparticles survive the thermal and mechanical loads.



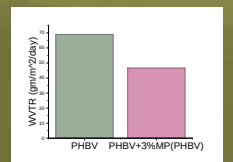


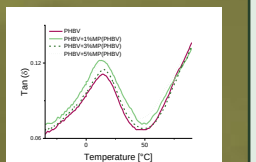
- ✓ Microparticles act as nucleating agent
- ✓ Biocomposites with 3wt.% PHBV microparticles show the biggest changes in their properties



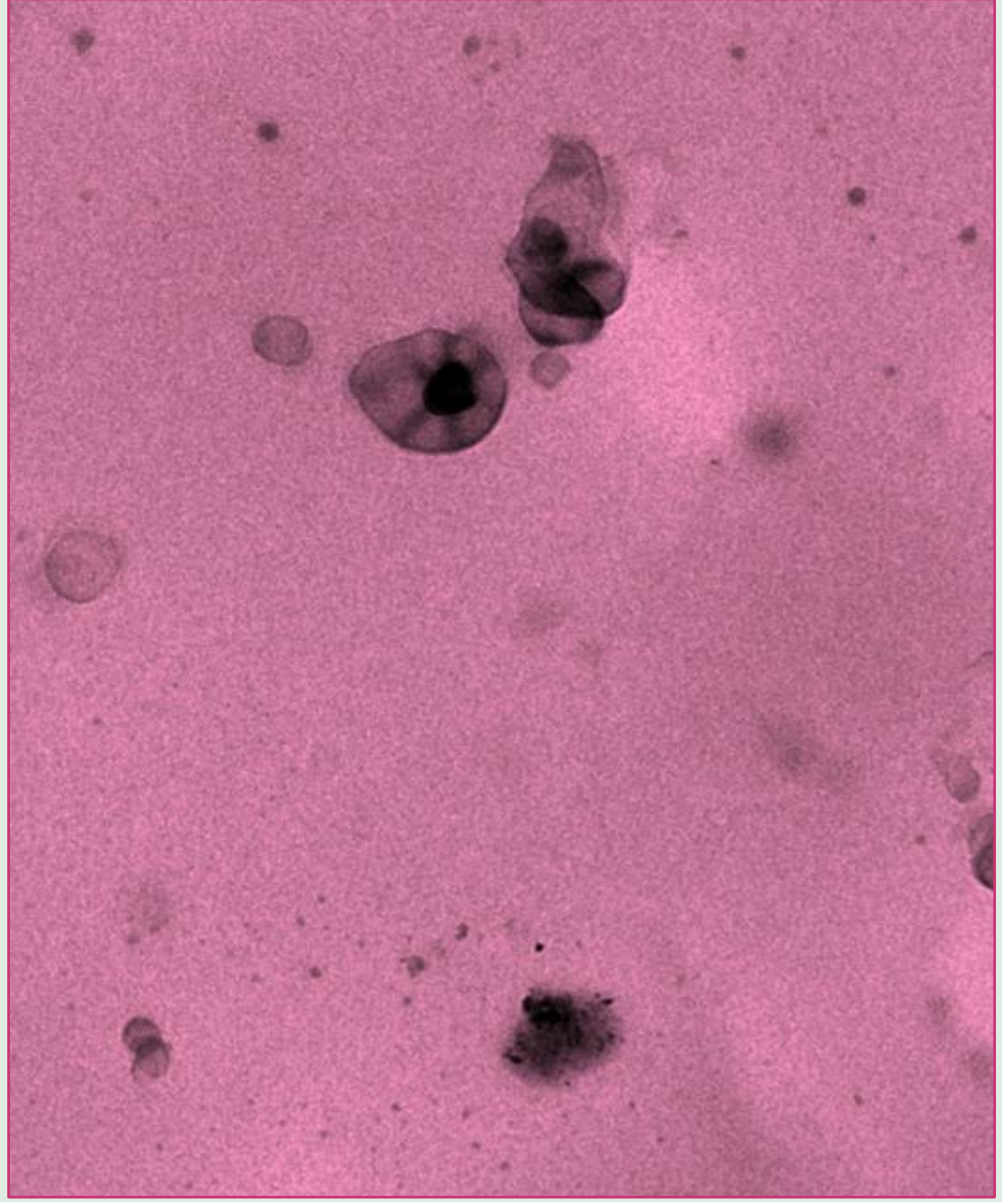


- ✓ Biocomposites show higher crystallinity, changes in crystal structure , thus higher stiffness and lower permeability





Promising biocomposites which needs to be further investigated...



Thank you for your attention!

Anja Schmidt

a.schmidt@udc.es

Grupo de Polímeros

Universidade da Coruña

Financiado por la Unión Europea

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Thanks for your attention!

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