

# **INDTECH2018**

## **Innovative industries for smart growth**

29-31 October, 2018  
Vienna, Austria

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PILLAR 2

Session 2.7

Bridging the gap between science and industry.  
Innovative technologies in biopolymers synthesis

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AIMPLAS

31 October 2018

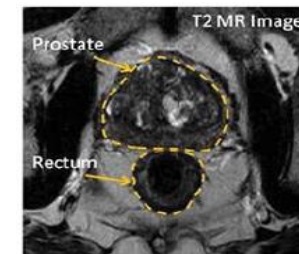
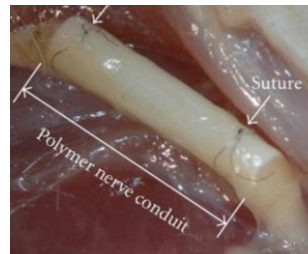
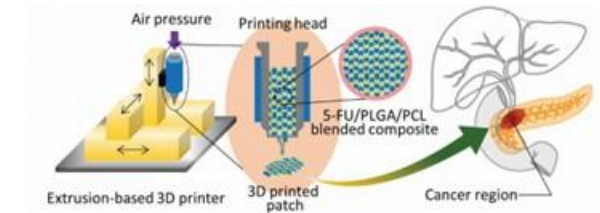
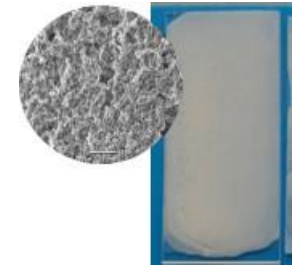
## The problem, the necessity...



AIMPLAS aims to add value to the society to improve the **quality of life** and ensure **environmental sustainability**.

**Synthesis Department** develops biopolymeric materials for medicine solutions:

- Nanomarkers
- Materials for diagnosis and therapeutic
- Biocompatible and bioabsorbable polymers
- Hydrogels
- Controlled release
- Bone and tissue regeneration
- Hybrid organic-inorganic materials





## The problem, the necessity...

### Synthesis of Polymers

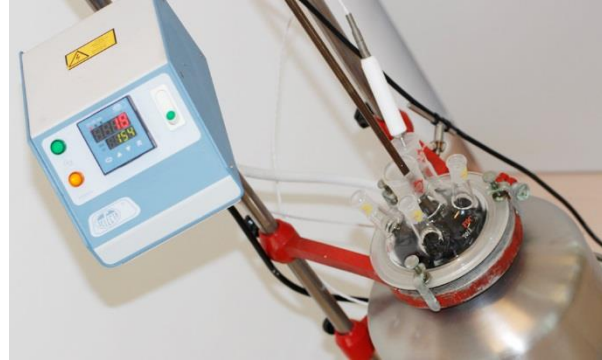
**Limitations:** 0.1 to 10-50 kg and beyond.

- Huge solvent quantities management
- Process development by solution synthesis.

- Process optimization, including
- Slow processes
- purification steps.

Strategies in polymer synthesis as:

- Control on morphology/structure of polymers (copolymers)
  - Radical polymerization.
  - Ionic polymerization.
    - Coordination.
- Batch processes (regeneration, cleaning times, discharge)
  - Polycondensation.
  - Ring opening polymerization





**The Valley of the Death!!!!**

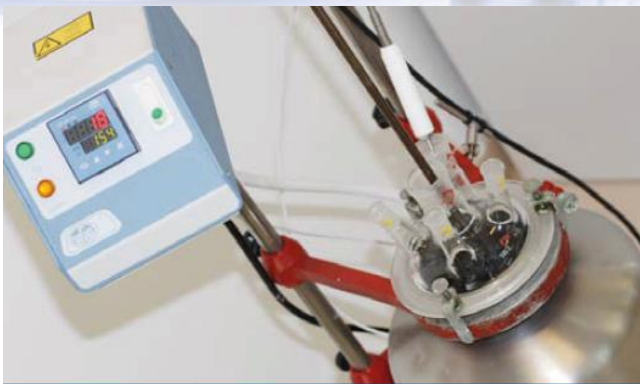
\* SOURCE: CERN

## REACTIVE EXTRUSION (REX)!!!

It is a continuous process in which an extruder is used as a chemical reactor, to carry out polymer synthesis







## Classic synthesis in reactor.

- In solution: better homogenization, but you have to remove the solvent to obtain the polymer (it requires a lot of energy).
- Molecular weight limited by viscosity and agitation.
- They require further processing of graining, addition additives, fillers, fibers, etc.
- For the production of large volumes of polymers
- Batch Processes

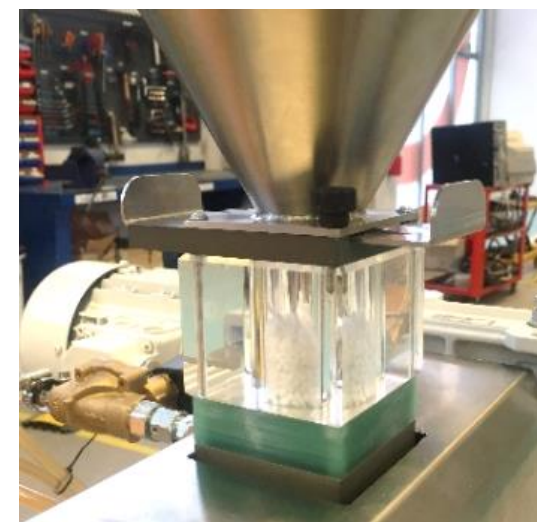
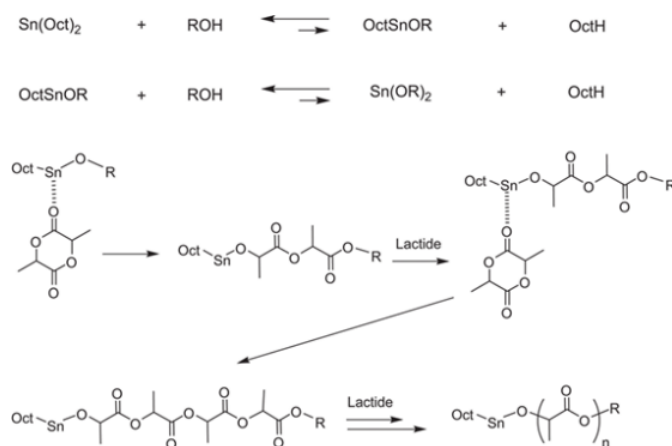
## Synthesis by reactive extrusion.

- Continuous horizontal reactor.
- Absence or minimal presence of solvent as a reaction medium (more sustainable).
- Good handling of high viscosities.
- Devolatilization to remove / recover unreacted monomer.
- High flexibility of process design.
- Possible integration of the synthesis and compounding process (additivation, loading / reinforcement, etc.).



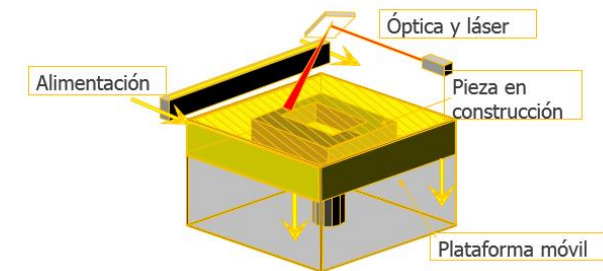
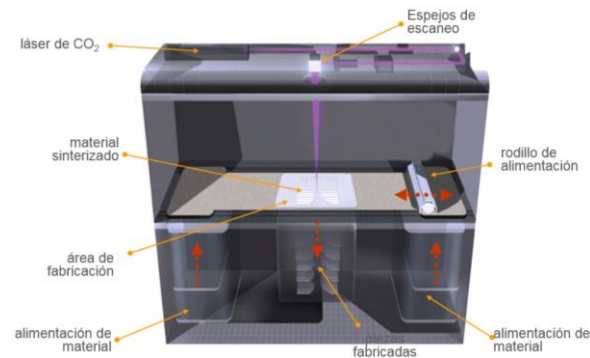


## SUCCESSFUL POLYMERIZATION OF PLA



Other Technologies that bridge the gap between science and industry are the **ADDITIVE MANUFACTURING TECHNOLOGIES**

The mantra is "**Need few units, complex geometry, small size**".







**INDustrial TECHNOLOGIES 2018**  
Innovative Industries for Smart Growth



**AIMPLAS**  
PLASTICS TECHNOLOGY  
CENTRE

Thanks for your attention

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Transport, Innovation  
and Technology

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