PHA – ROAD TO 3D

Pascal Gerlach
3N Kompetenzzentrum e.V.

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- Current state
- PHA at 3N
- Challenges & Chances
  - Material
  - 3D-printing
- Outlook

Current state

- Most used 3D-printing filaments
  - PLA -> biobased, (not) biodegradable
  - ABS-> fossile resources
  - PETG-> biobased, not biodegradable
- Support and failed prints are waste
- Market outlook
  - Consumer Market

PHA at 3N

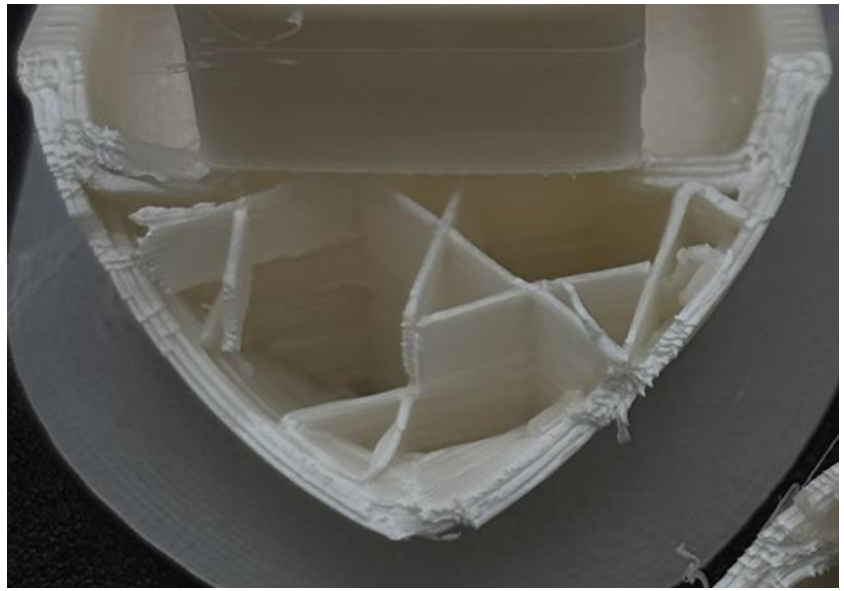
- Compounding & filament production at 3N
  - PHA + natural fibres (+Additive)
  - Biomer: Injection moulding
  - ENMAT: 3D-Printing

- 3D-printing with conventional consumer 3D-printers

- Challenges:
  - Agglomeration and particle size (0,4mm Nozzle),
  - Materialflow (filament and 3D-printing)
  - Additives (Biobased)

Challenges & Chances

- Material properties of different PHAs vary (e.g. MFI, Modulus)
- High layer to layer bonding
- Small process window
  - Low process temperature
  - No bed heating
  - Overall less energy consumption (LCA)
- Dialed in process
- Price



Design & Process Rules

- avoid Overhangs > nozzle Diameter
- Small perimeters possible → high layer to layer adhesion
- High Cooling → prevent post crystallization
- First layer adhesion → minimize warping
- slow cross-section changes

  → minimize layer time changes
- use of fillets/ chamfers

Outlook

- Ongoing tests
  - Additives
  - Natural fibres (e.g. paludi culture)

- New Designs or applications
  - Project waddensea
  - Films
  - Browsing protection (Fegeschutz)

Thank you!

„ChatGPT, please make a picture of a guy sitting in a 3D-printed benchy in the wadden sea.“