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SECTOR SKILLS STRATEGY
IN ADDITIVE MANUFACTURING

REAL LIFE EXAMPLES AND PROFILES FOR AM

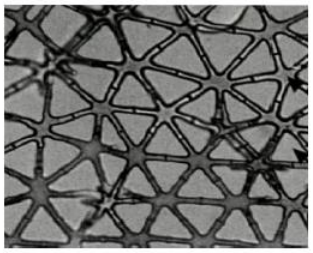
Project No. 601217-EPP-1-2018-1-BE-EPPKA2-SSA-B

Inspired by Nature

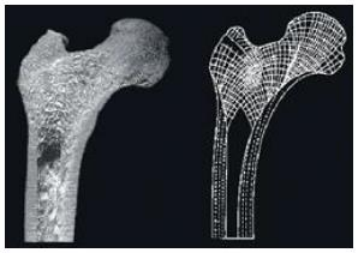
- Example 1: Biomimicry-Design like Mother nature (Courtesy of Fraunhofer)

Honeycombs [10]

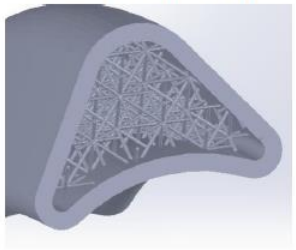
Stalks [11]



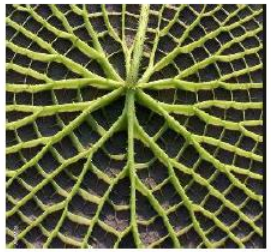
Juncus [12]



Bone [13]

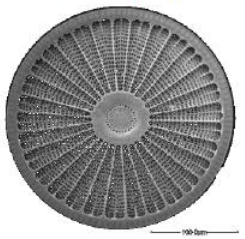


Toucan beak [14]



Giant water lilly [15]

Glass sponge [16]

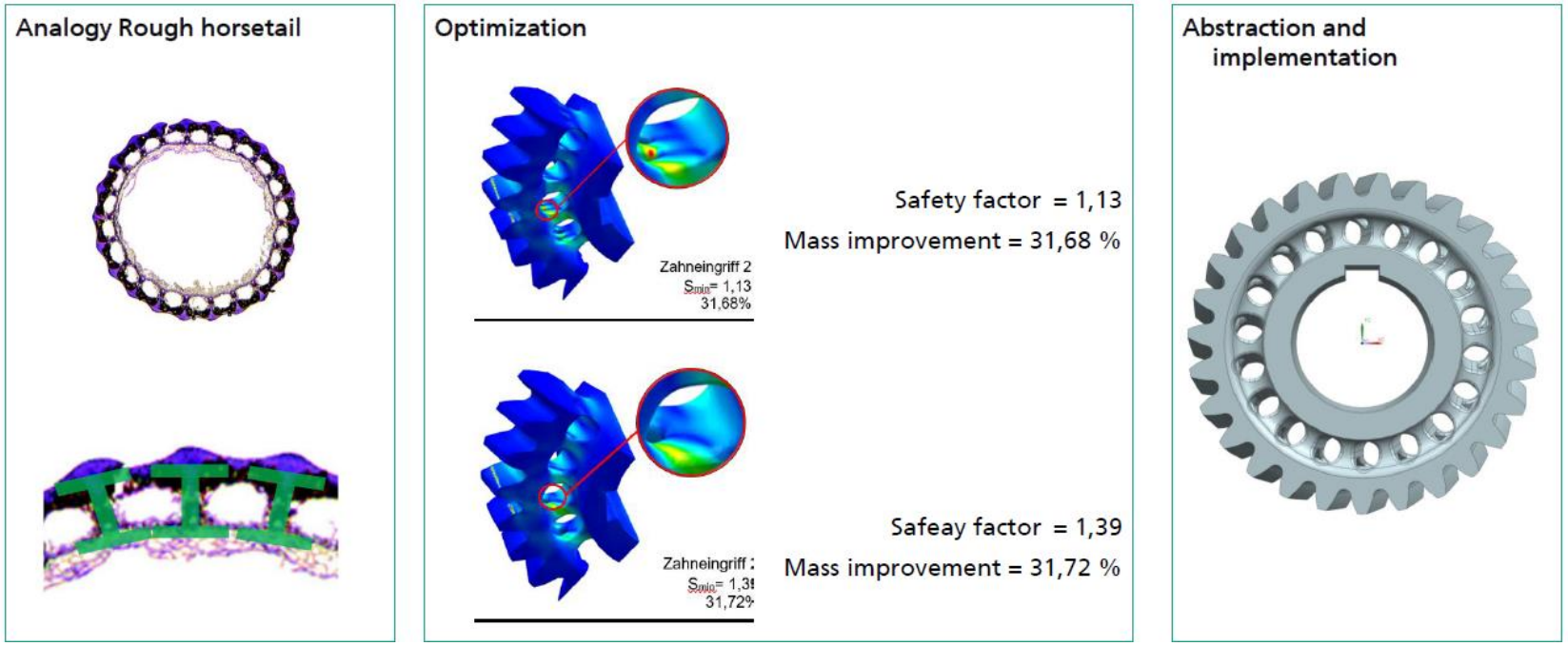


Diatom algae [17]

10. Rayon de miel 11. Queue de cheval 12. une plante à fleurs 13. Os
14. Bec de toucan 15. nenuphar 16. éponge de récif 17. algue océanique

Fraunhofer IGCV

- Example 1: Biomimicry - Used in a technical part design (Gear)



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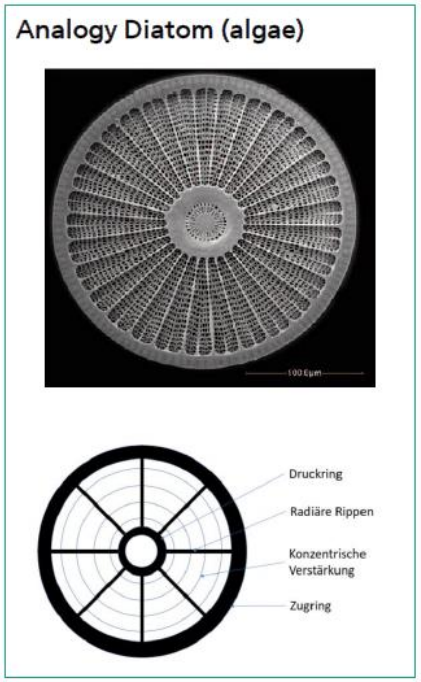

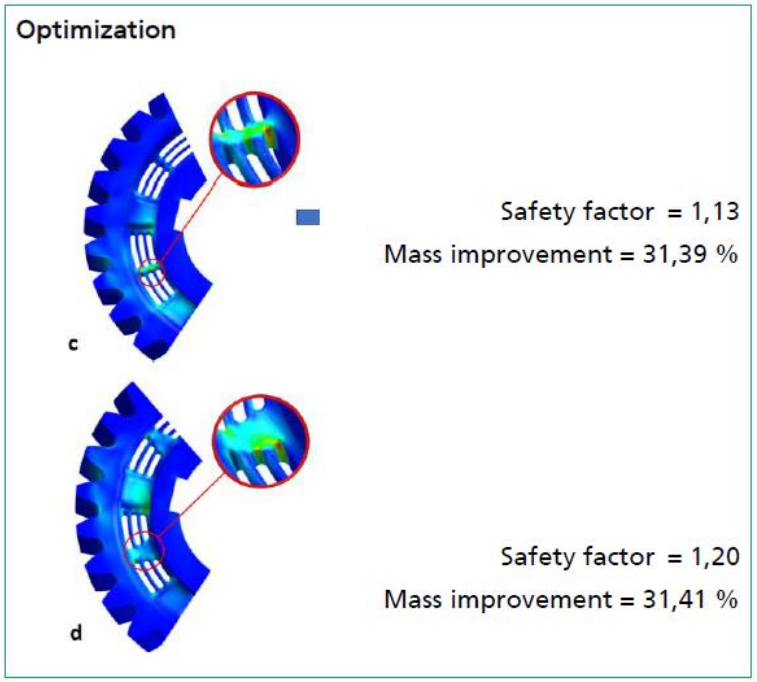

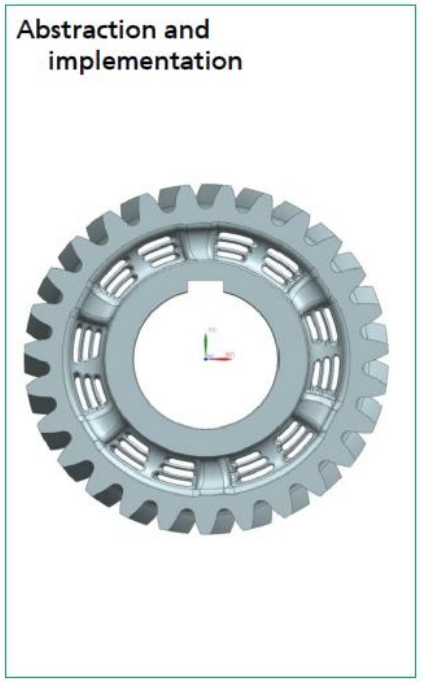

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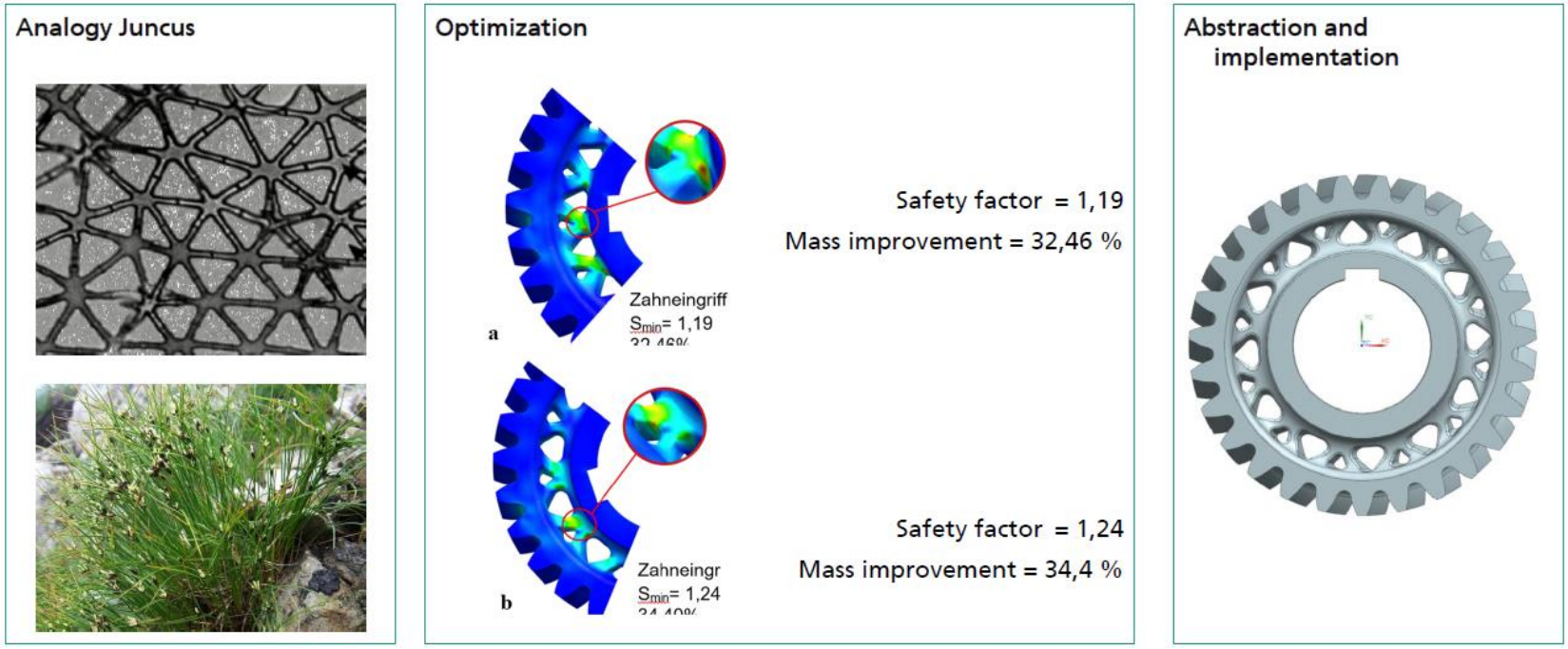

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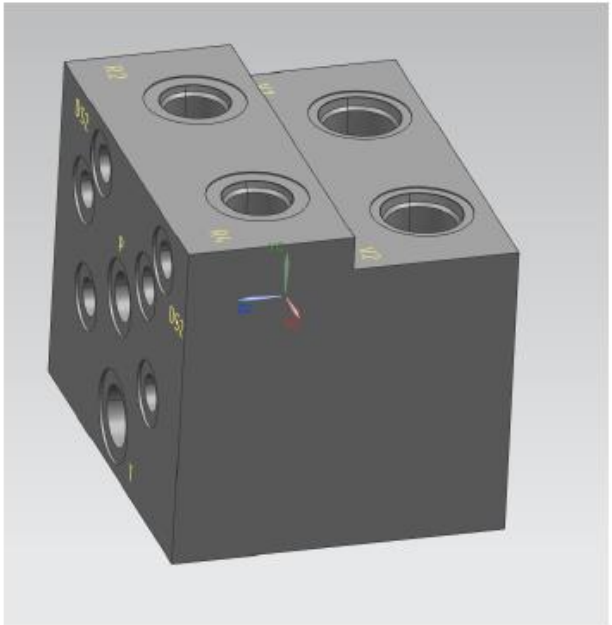
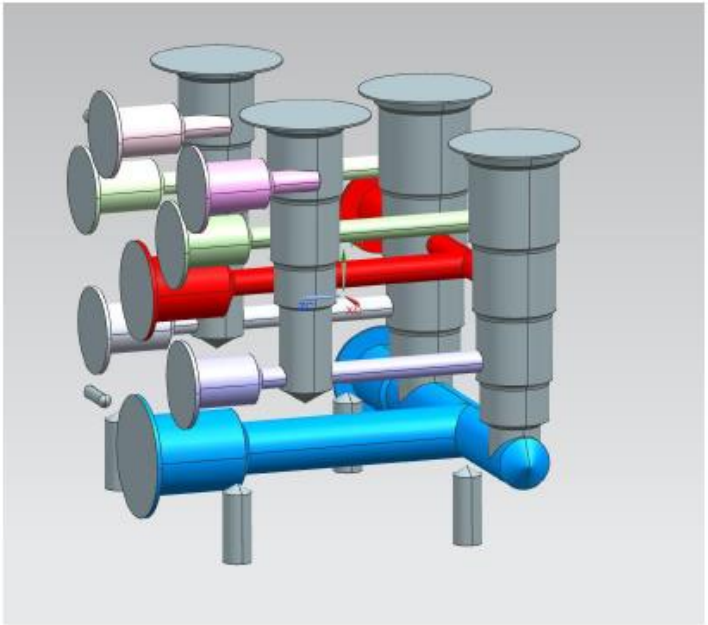
Less Heavy, More Efficient

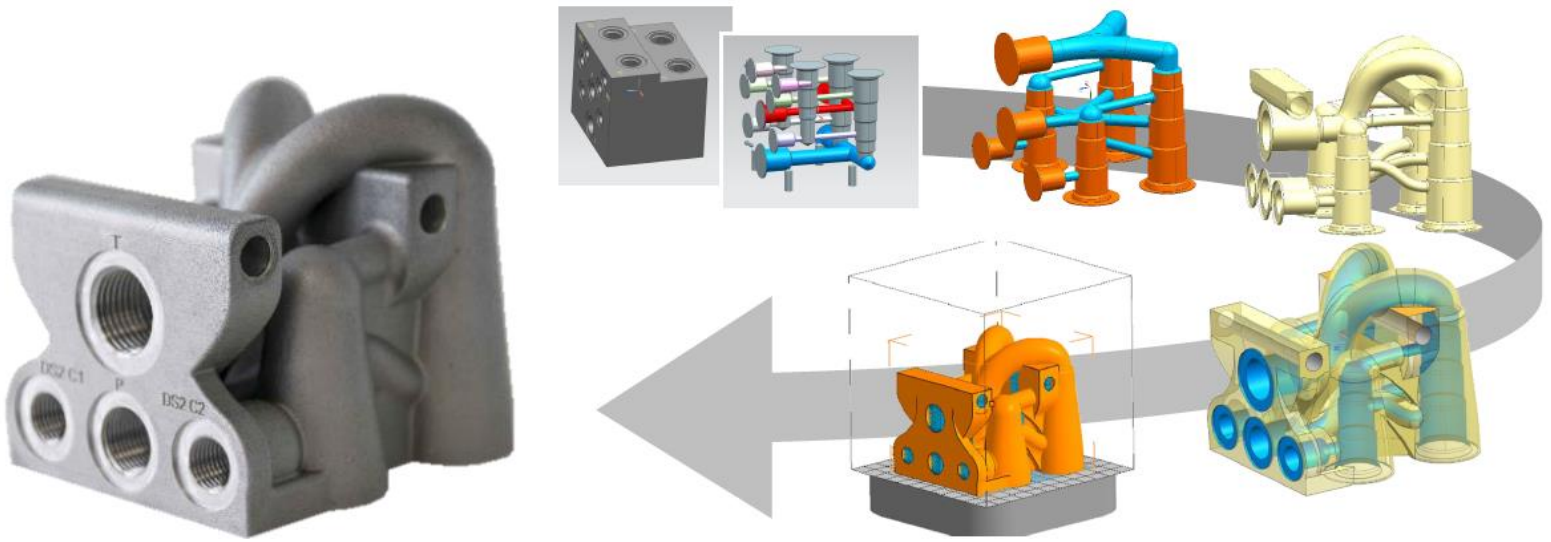
- Example 2: Hydraulic Block (Courtesy of Fraunhofer)





Fraunhofer
IGCV

- Example 2: Hydraulic Block



✓ AM hydraulic block offers 81% of weight reduction

✓ It holds a pressure of 300 bar (like conventional part).

Real Life

- Example 3: Passive NIP (Courtesy of Materialise)

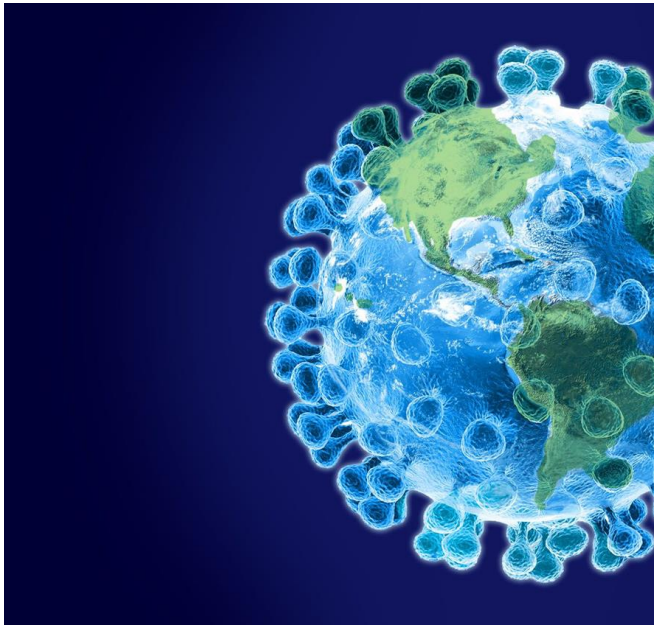
When the patient is deteriorating with a higher need for oxygen, there is the need to switch towards **positive oxygen pressure** in the airways pushing back the fluids in the lungs which will lead to a **better uptake of oxygen**. It is a **safe** thing to do. Because of the mask there **is low risk for contamination** and it's not invasive. **The high mortality rate** related to the **invasive ventilation** is exactly what we try to avoid with the passive PEEP approach. The ventilators are putting so much pressure on the lungs in the inhalation phase that they do **damage to the lungs of many Covid patients** in an effort to keep the oxygen level high.

Prof. Pulmonology W. De Backer
University Hospital Antwerp, Belgium
Director of respiratory imaging company FLUIDDA

- Example 3: Passive NIP

KEY PROBLEMS IN HOSPITALS

- COVID-19 patients are in need of oxygen
- Positive pressure (PEEP) is required to keep the alveoli open for severe patients
- Caregivers are concerned about aerogenic contamination, so hospitals initiate invasive ventilation sooner and more
- Patients suffer from complications related to long periods of invasive ventilation and very high positive pressures
- Shortage of ventilators in some countries

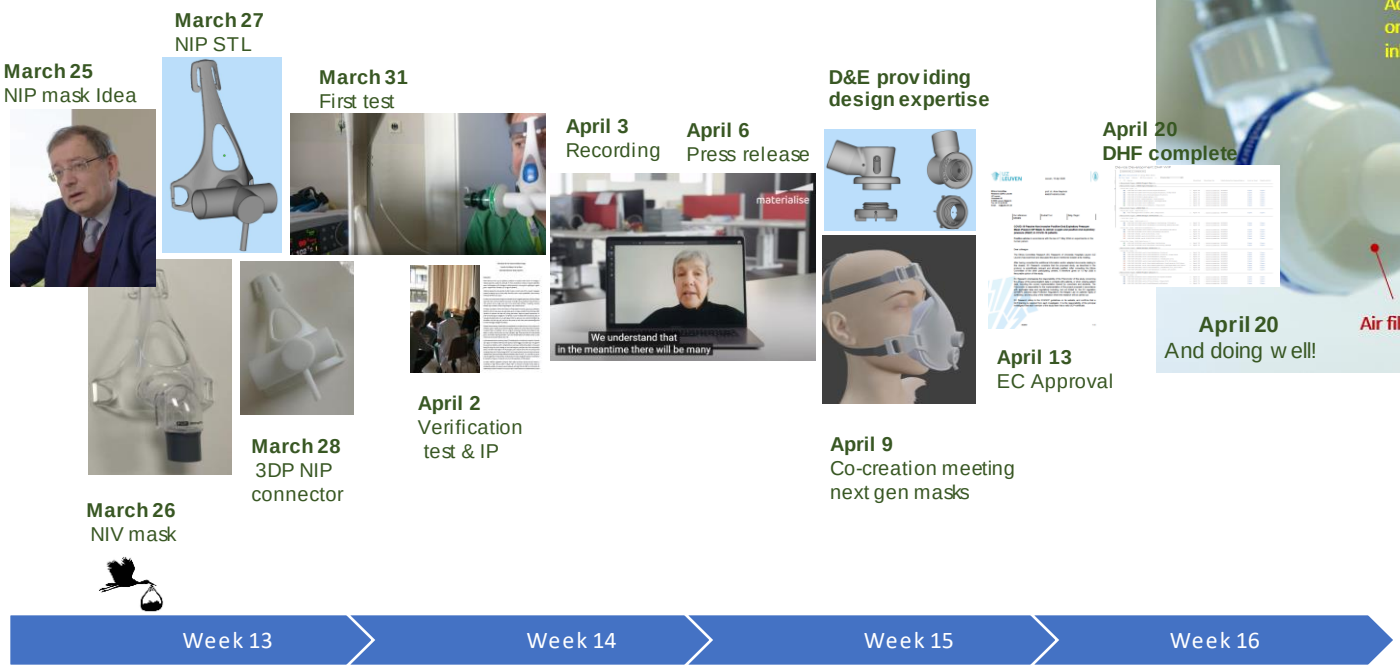


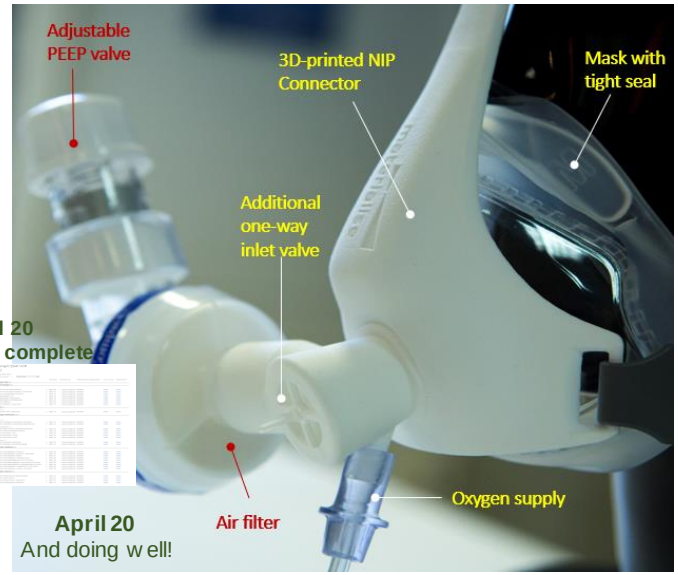
Passive: no need for a mechanical ventilator, relying on the patient's breathing
Non-Invasive: no need for intubation, but using a mask instead

PEEP: Positive End Expiratory Pressure. Create a positive pressure in the lungs while exhaling (like while blowing up a balloon)

- Example 3: Passive NIP

From idea to patient in 25 days...





Inspired by AM

- Profile 1: Dr. Anke Kaletsch (Background)

Since June 2015

- **Head of Division Powder Technology** at the Institute for Materials Applications in Mechanical Engineering (IWM), RWTH Aachen University

Since December 2014

- **Deputy Head** of the Institute for Applied Powder Metallurgy and Ceramics (IAPK) e.V.

2010 –2015

- **Dr.-Ing., Mechanical Engineering,** RWTH Aachen University
  - Doctoral Thesis: "Reactive Air Brazing of Ceramic-Metal-Joints and their Aging Behavior in Oxidizing Atmosphere"

2005 –2010

- **Dipl.-Ing., Mechanical Engineering,** FH Aachen University of Applied Sciences
  - Diploma Thesis: „Joining Alumina with Glass solders – Characterization and Optimization"

RWTH AACHEN UNIVERSITY

• Profile 1: Dr. Anke Kaletsch (Daily work)

- **Working on industry projects (R&D or services)**
  - Writing Proposals/Quotations
  - Discussing topics with industry
  - Giving updates of the results to the project partners at regular intervals
  - Writing reports
- **Academic teaching**
  - Lectures
  - Seminars
  - Practical training

Working at the University means:

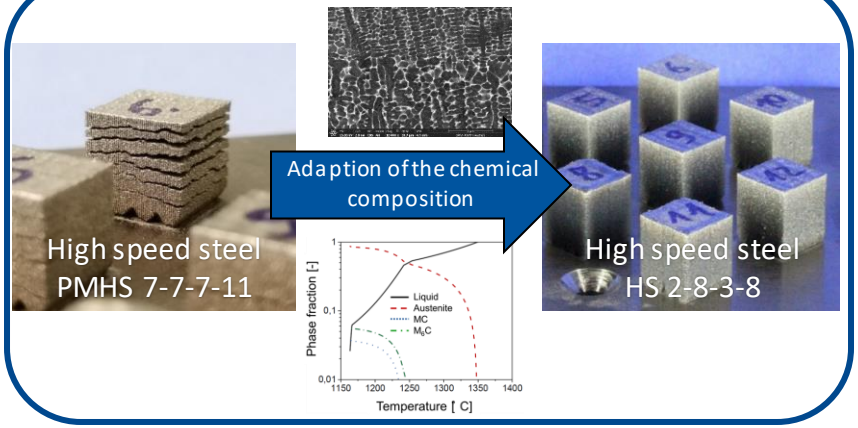
- Further scientific qualification
- Varied duties and responsibilities
- Learning every day something new
- A lot of reading and writing
- It will never be boring

- Profile 1: Dr. Anke Kaletsch (Projects)

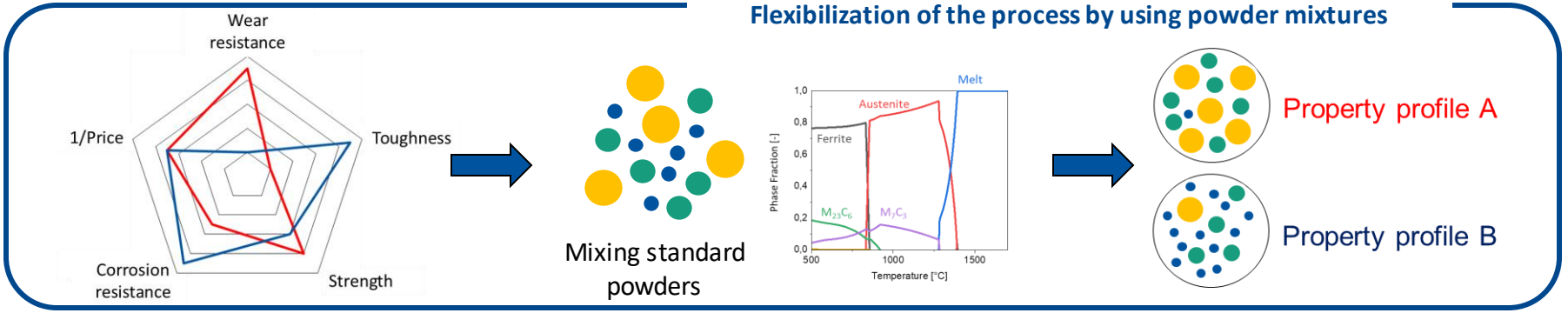
Motivation for materials development

- To improve the processability
  - Hard materials that are difficult to manufacture
- To increase the material flexibility
  - In-situ alloying by using powder mixtures to achieve a desired microstructure/ properties

Materials that are difficult to manufacture



Flexibilization of the process by using powder mixtures



- Profile 2: Adeayo Sotayo (Background)

- Researcher, Academic, Chartered Engineer (Since 2016)
  - ❖ University of Liverpool
    - ✓ **Materials and Structures**
  - ❖ Brunel University London
    - ✓ **Additive Manufacturing**
- PhD Engineering, Lancaster University, UK (2013-2016)
- Mechanical Engineering, University of Liverpool, UK (2010-2013)
  - ❖ Graduated with First rank in class
  - ❖ Skipped Master's Degree
- Chrisland College Idimu, Senegal (2003-2009)

THE UNIVERSITY of LIVERPOOL

Brunel University London

- Profile 2: Adeayo Sotayo (Daily Work)
  - ❖ Review literature
  - ❖ Design experiments for materials characterisation and analysis
  - ❖ Increased understanding of AM material properties for several applications
  - ❖ Organize Pilot Courses in AM
  - ❖ Educate and upskill people in AM
  - ❖ Academic publications
    - ➢ Over 25 publications in Engineering, Materials & AM

- Profile 2: Adeayo Sotayo (Advices and Tips)

  - ✓ Connect and follow AM projects, organisations or people
    - ❖ Keeps you informed of current developments & opportunities in AM
  - ✓ Be pro-active and take opportunities
  - ✓ Think of the **challenges discussed earlier** and ways to solve or improve them
    - ❖ Multidisciplinary skillset (AM Materials, AM Design, AM Processes & Post-processing)
  - ✓ Rapid growth and constant development of AM
    - ❖ **Continuous** training, learning and professional development
    - ❖ Be open to creativity and innovation
    - ❖ Be prepared to adapt

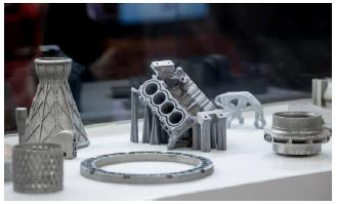
Construction

Source: m-tec (2020)

Food

Source: Fabbaloo (2018)

Aerospace/Automotive



Source: AMFG.ai (2019)

• Profile 3: Aydin Yagmur (Background)

- Additive Manufacturing Consultant (Since 2017)
  - ✓ EOS Gmbh, Germany
- Technology Development Engineer (2013-2017)
  - ✓ TEI (Turkish Engine Industries), Turkey
- Materials Quality Assurance Engineer (2010-2013)
  - ✓ Bosch Rexroth, Turkey
- Master of Science (M.Sc.), Materials Science (2014-2016)
  - ✓ University of Stuttgart, Germany
- Bachelor of Science (B.Sc.), Metallurgical Engineering (2002-2008)
  - ✓ Middle East Technical University, Turkey

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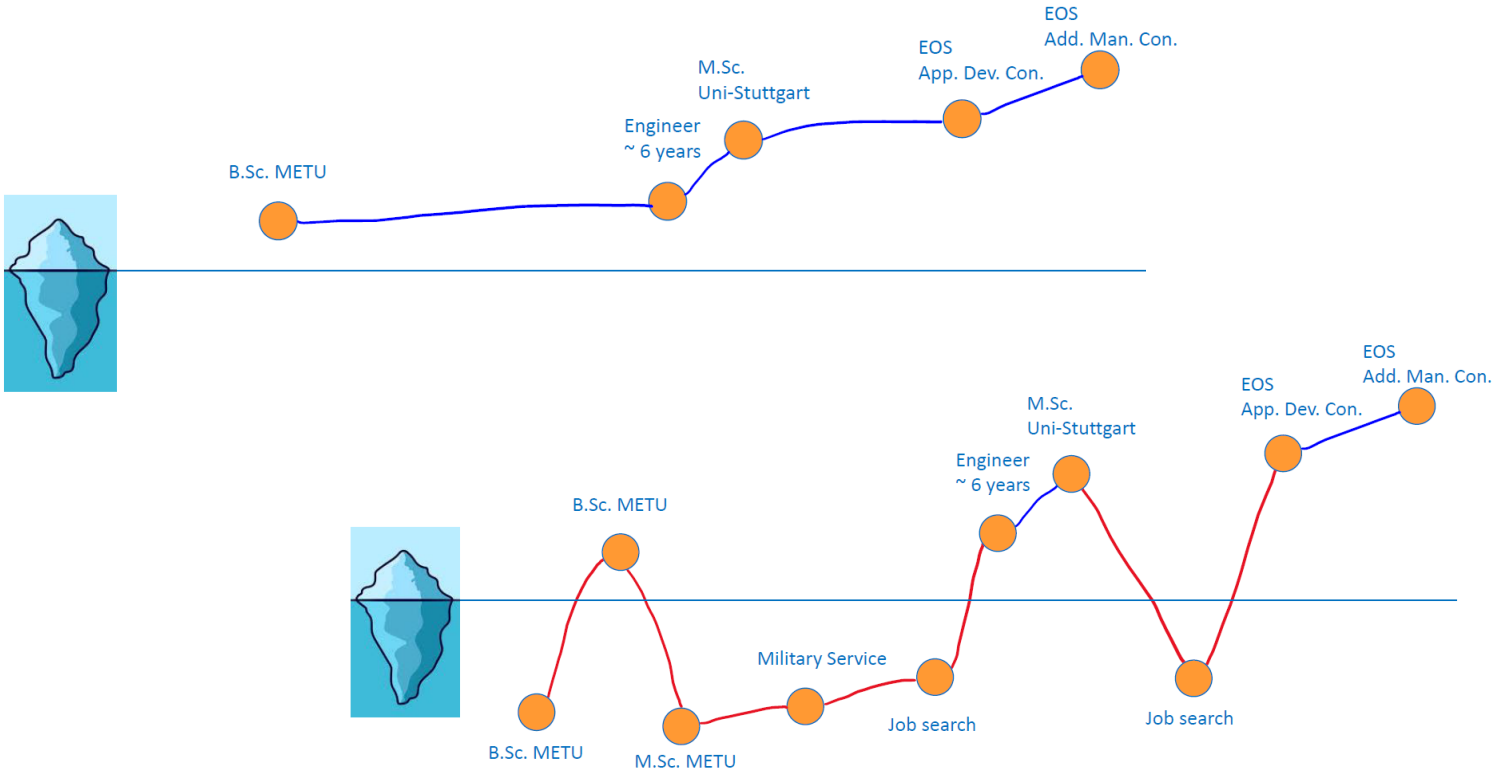
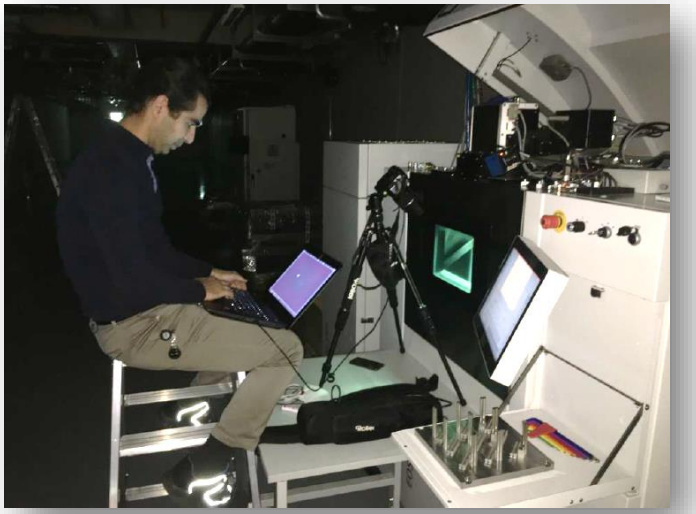
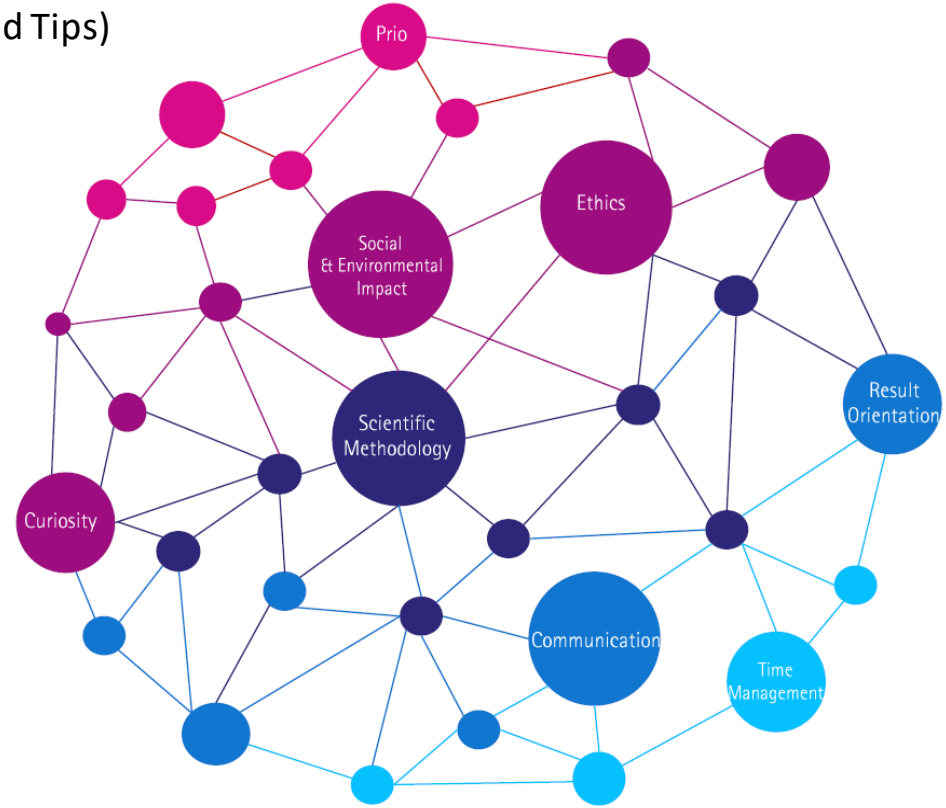
- Profile 3: Aydin Yagmur (Career Steps)



- Profile 3: Aydin Yagmur (Advices and Tips)





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