Application of Mycelium based Materials in Aircraft Cabins

hyfen

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AIRBUS

Vision

Demonstrating potential applications mycelium based materials in an aircraft cabin through foundational research & design to inspire deployment

Introduction

Regulations, duty, consumer mindset shift, internal fuel innovations and competition in material innovations are key forces driving Airbus to look for lightweight & circular interior materials. Mycelium materials appear promising but have several challenges yet.

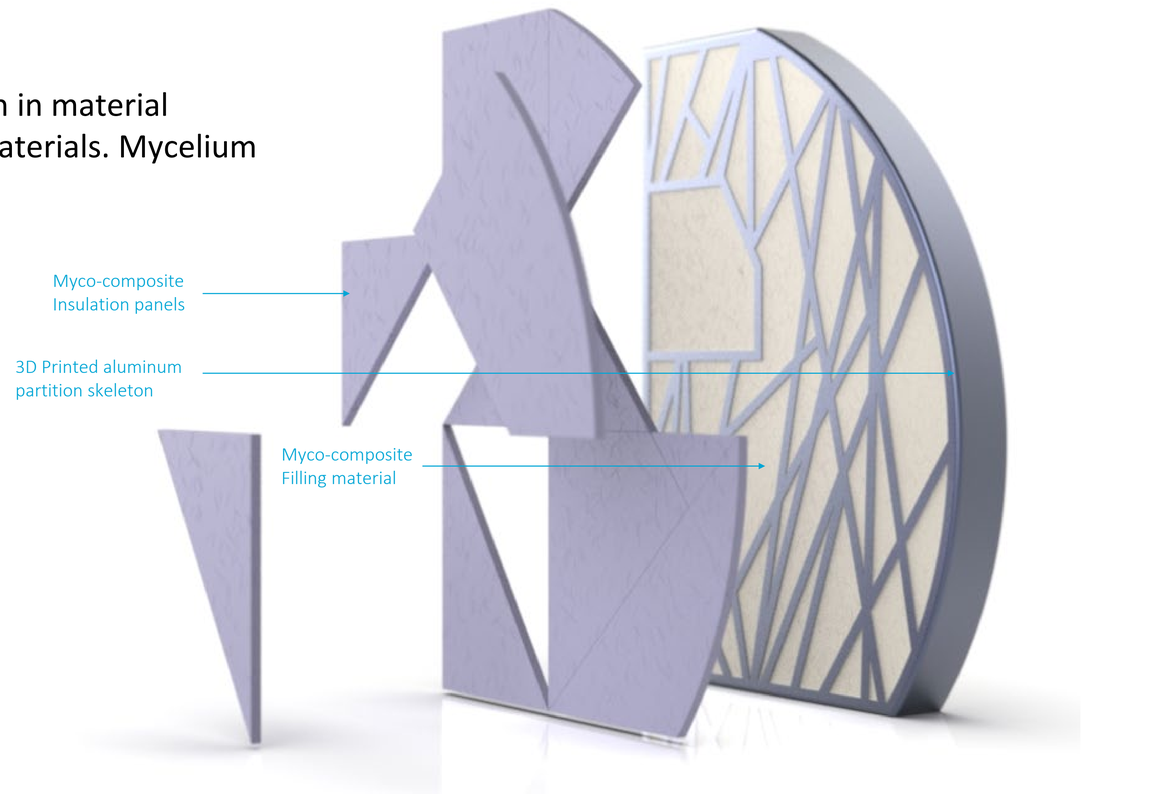


Fig 1: A demonstrated application – Mycelium composite acoustic panels and filling materials for bionic partitions in future Airbus aircrafts.

Key Challenges

- Lack of literature or ***demonstrated applications*** specific to the aerospace context of mycelium based materials(MBMs).
- Incomplete knowledge of properties or ***inadequate material properties*** of the material for aircraft cabin applications. Examination of Flammability, Smoke, Toxicity in addition to mechanical properties and environmental properties are crucial.
- Requirement of knowledge of ***technical, environmental*** and ***experiential performance (with intented users)*** of materials before deployment.

Mycelium Materials

- Mycelium based materials can have a large variety of physical & temporal qualities.
- Pure mycelium materials (no substrates) can be paper like, leathers, foams or like bacon.
- Myco-composites (on lignocellulosic substrates such as hemp hurd, straw etc.) resemble rigid foams or panels.

Fig 2. Commercial pure mycelium materials resembling foam and leather
Image source. Ecovative.com and Mycoworks.com (3)

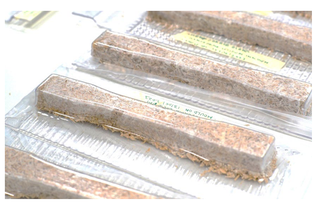
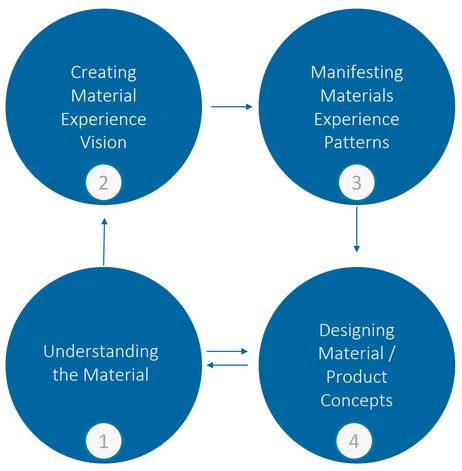


Fig 3. Mycelium composites produced by the student

Methodology



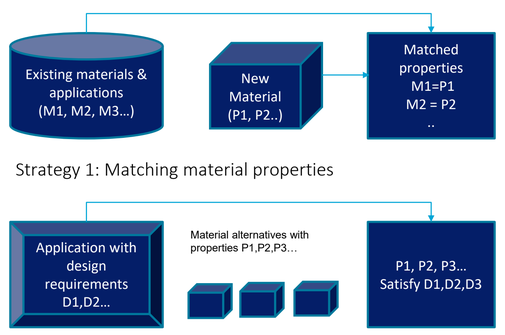


Fig 4,5 : The methodology used for the thesis assignment was adapted from 'Material Driven Design' (1)methodology developed in TU Delft and strategies for 'Finding applications for materials' (2) by Michael F Ashby

Results

- MBMs have strength to weight ratios with ranges similar to open cell foams to insulation boards and satisfactory flammability (biochars).
- They have low carbon footprint but life cycle assessment shows high sensitivity to the energy mix of production location. Sterilization & dehydration are environmental hotspots.
- Users perceive it's biological origin & associate sustainability with its experience

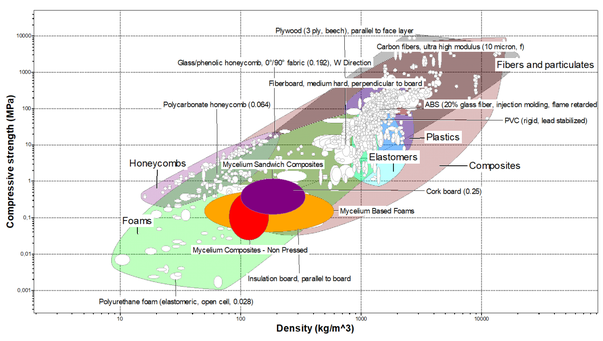


Fig 6. Ashby plot of compressive strength vs density ratio of MBMs produced by researchers, against aerospace materials database in Granta Edupack 2021

Conclusion

- Mycelium based materials can be effective explored further for *non-structural applications* in an aircraft cabin.
- Qualities to leverage are its ***mouldability, acoustic & thermal insulation***, ***sustainable end of life potentials, apparent experienced sustainability*** and it's ***customizability.***
- As an Industry, future challenges to overcome would setting up bio design laboratories with sophisticated sterilization and accurate controlled conditions.
- Overcoming uncertainties over repeatability in a large scale mass production scenario using a living organism is the next step.

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