VRIJE UNIVERSITEIT BRUSSEL

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Elise Vanden Elsacker**

The public defense will take place on **Tuesday, 20th April 2021 at 5pm.**

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MYCELIUM MATTERS – AN INTERDISCIPLINARY EXPLORATION OF THE FABRICATION AND PROPERTIES OF MYCELIUM-BASED MATERIALS

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Abstract of the PhD research

Environmental pollution and scarcity of natural resources lead to an increased interest in developing more sustainable materials. The traditional construction industry, mostly based on the extraction of fossil fuels and raw materials, is therefore called into question. Biological materials made by growing mycelium-forming fungal microorganisms on natural fibres can form a solution. In this way, organic waste streams, such as agricultural waste, are valorised while creating a biodegradable material at the end of its life cycle, a process that fits in the spirit of a circular economy. Despite this promise, these materials' characteristics are mostly unexplored. More scientific insights about the growing and fabrication processes are required before incorporating these biomaterials into our daily lives.

Therefore, this dissertation's main goal is to explore the principal factors affecting the biological and material properties of mycelium materials and broaden the potential of new fabrication technologies for architectural applications with fungal organisms. Ultimately, the research provides novel insights and a comprehensive overview of several crucial aspects during the production of fungi-based lignocellulosic composites. A method for selecting fungal species that incorporates biological, chemical and mechanical performance criteria has been developed. The interaction between fungi and their feedstock and the material properties of different types of feedstocks are investigated. Then, the optimisation of mechanical properties with different types of additives is studied. A novel fabrication process to produce largescale architectural formwork is developed. Finally, various digital additive fabrications and design strategies that improve the colonisation of the fungi in a given geometry are explored.

This hybrid investigation across disciplines is guided by the motivation to explore the growth and fabrication possibilities of mycelium materials from a bioengineering, material engineering, computational fabrication and architectural perspective.