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 **Francesca Furia**

The public defense will take place on **Thursday 19th September 2024 at 4:00 pm** in room **I.0.01** (Building I, VUB Main Campus)

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DYNAMIC COVALENT POLYMER NETWORK PROPERTIES BY DESIGN FOR ADDITIVE MANUFACTURING OF SELF-HEALING MATERIALS

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Abstract of the PhD research

3D printing, also known as additive manufacturing (AM), is becoming very popular in various industries for making customized products. This technology builds objects layer by layer, allowing for the creation of complex designs and quick prototypes to test functionality. One common method of 3D printing is by material extrusion where melted plastic filament is continuously pushed out a through a heated nozzle and deposited it onto a print bed.

Different types of plastics are used in 3D printing, but recently an innovative type, self-healing plastic, has been introduced. Self-healing means that this type of plastic has the ability to repair itself, just like our skin with a cut. This is beneficial because it reduces material waste and extends the life of products. When 3D printed, this material can create stronger and more uniform structures compared to other commercial materials. However, these self-healing materials are less viscous when melted, making it harder to print complex designs.

This PhD project focused on adapting the structure and composition of these self-healing plastics for 3D printing. By studying the material properties and the printing process, the author aimed to improve both the strength and complexity of the printed objects. Different strategies were tested, such as adding fillers like nanoclay and carbon black to increase the material's viscosity and stability during printing. Additionally, combining different types of chemical bonds within the material structure was investigated to enhance the material's performance at high temperatures and speed up the healing process. These findings were combined to determine a set of important criteria to assess the printability of these innovative materials.