

## 3D PRINTING AND CIRCULAR ECONOMY: REMANUFACTURING OF FIBER GLASS COMPOSITES

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The use of 3D printing for real life objects is often limited to the low amount of materials that can be used or, in some cases, for the cost of the technology. Since the advent of Makers, 3D printing processes started to be cheaper and enthusiasts and researchers began to experiment with them. In the last years the experimentation process has found a prolific terrain fed by low cost materials and machinery, and by a vibrant community. This helps the experimentation on different materials, like ceramics and thermosetting polymers. The possibility to 3D print thermosets materials enabled a whole class of materials to candidate as 3D printable. A flexible 3D printing process for viscous materials have been developed, such process could be used to 3D print thermoset resin reinforced composite materials. It has been demonstrated that recycled composite material can be 3D printed enabling the recycled material re-manufacturing, following a circular economy approach. Since the first wind farms constructed in the world are turning 25 years old, and will soon be decommissioned, the aim of this research is to build a circular economy path for thermoset recycled fiberglass reinforced materials in which the 3D printing process creates the added value for a new class of re-manufactured composites and products. In order to 3D print the material, the viscosity of the system has been analyzed and the polymerization process has been studied and optimized. A frugal innovation approach have been used: low cost 3D printers could be easily modified to 3D print the new composites, and, thanks to the simplicity of the system, the process could be scaled up, allowing for bigger volume 3D print. Some proposals regarding the possibility of using this novel approach for the construction of attractions within amusement parks have been studied and prototyped.

### Biography

Andrea Mantelli has completed his Master of Science in Materials Engineering and Nanotechnology from Politecnico di Milano with an original work on continuous composite 3D printing. He has completed his Internship at FabLab London in 2015 where he consolidated his 'maker' attitude. Currently he is working as a Research Fellow at +Lab in the Department of Chemistry, Materials and Chemical Engineering "Giulio Natta" at Politecnico di Milano.

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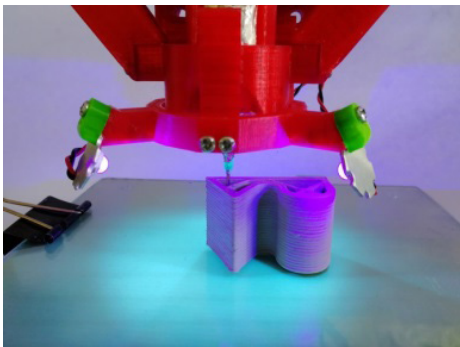


Figure 1: Modified 3D printer during the 3D printing of a sample with thermoset resin recycled fiberglass composite



Figure 2: 3D printed model of an amusement park gate