Recycled Hospital Waste as Raw Material for 3D-Printed Furniture

Resting in Good Conscience

Robotics meets additive manufacturing: when Kuka robots produce furniture, they do not take work away from carpenters by any means. The chair and bench modules made of recycled hospital waste, named Twine – designed by HagenHinderdael in London – are a novelty in the world of furniture, engineering, and recycling.

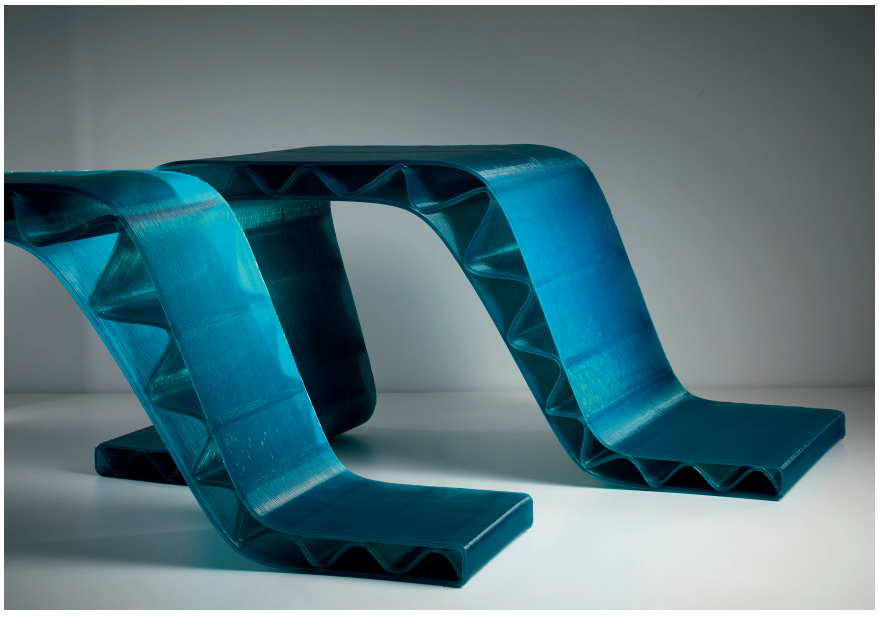
Designers Lisa Hinderdael (left) and Sofia Hagen present a better side of plastic waste. The KR Quantec used to print the larger Twine elements is in the background. © HagenHinderdael

The HagenHinderdael design studio was founded by Sofia Hagen and Lisa Hinderdael in 2020. "We combine product design with art to create sculptural products and immersive installations, working at the touch point between sustainable design and innovative technology," is how the two architects and designers describe their creative approach. Hinderdael is from Belgium, Hagen from Austria – and both have enjoyed success in international settings.

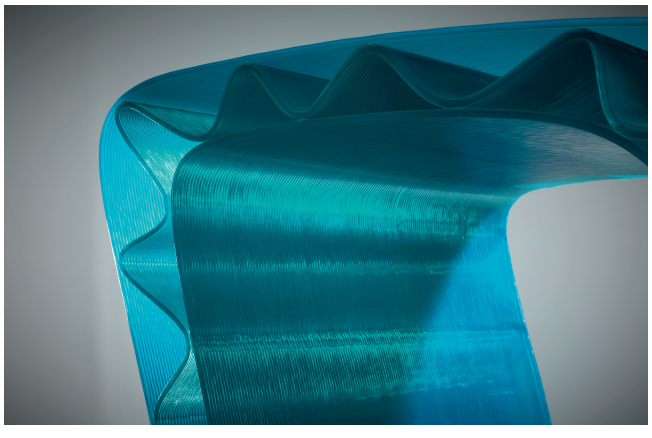
Twine – urban furniture for public spaces – was designed for the third edition of the "Guiltless Plastic" campaign. It is curated by Milan's gallery owner Rossana Orlandi, regularly prompting artists and designers to exhibit their projects to address plastic waste. "So we invented Twine. Our furniture had to be playful, comfortable and durable, and we wanted to use the filaments from Reflow for production using 3D printing," is how Sofia Hagen describes the original project idea. Reflow, an award-winning social enterprise in Amsterdam dedicated to the fight against environmental pollution with plastic waste, obtains its materials for additive manufacturing from recycled waste plastic. The raw material for the functional, modular furniture elements is a rPET-G filament (recycled polyethylene terephthalate-modified with glycol) made of discarded, thermoformed medical bowls.

Delivering Durability and Aesthetics – without Lifting a Finger

The Twine modules are 1.06 m long, 50 cm high and 30 or 45 cm wide. The design alone was crowned as the finalist for the RO Plastic Prize 2021. Winning this prize for objects made of recycled plastic makes headlines across Europe. Therefore, a Twine seat was sent to the exhibition in Milan as part of the competition. HagenHinderdael engaged Ai Build in London, which has already done a lot of work with Reflow filaments, to produce this and another piece of furniture.



The seating modules are produced in two widths from recycled PET-G filaments using additive manufacturing. © HagenHinderdael



The AiSync software of the Kuka system partner Ai Build supports dynamic, multi-axis motion control for industrial 3D large format printing. © HagenHinderdael

Ai Build is a SaaS (Software as a Service) business founded in 2015, "currently employing 20 people and five Kuka robots" as Chief Operating Officer Michail Desyllas describes it. The team mainly works for tier one companies in the aviation, automobile, marine, and energy industries. But more and more architects and designers are interested in the offers as well. Desyllas reports: "The geometry of the components and the desired aesthetic finishing were the greatest challenges in this special project. We were not allowed to change anything."

Ai Build decided that two robots, a KR30 L16 of the KR Iontec series and a KR90 R2700 of the KR Quantec series, would do the job "because these robots have the range required to make such parts. They also have our software fully integrated, allowing us to monitor the quality and report defects in real time," says Michail Desyllas.

Less than two weeks elapsed from the order to the finished furniture. Since Twine is intended to flow like waves, Ai Build constructed a special mold, a sort of curved double bed, on which the hot material from the 3D printer was allowed to cool and solidify. The narrower elements were made by the KR30 L16, the wider ones by the KR90 R2700. Each robot was equipped with a filament extruder system (model: Ai Maker).

Two Robots and Four Filament Flows

This system can transport up to four filament flows in different colors, supporting a rich play of colors and transparency gradients within the elements. Desyllas grants that the application of the rPET-G filament was tricky: "Each layer has to be applied within a certain window. Not directly after the previous layer, to prevent sagging, but not too late either, otherwise the layers may not adhere to each other." According to the data sheet provided by the manufacturer (Reflow), the filament is processed at a nozzle temperature of 210 °C and a print bed temperature of 75 °C – with a printing width of 6 mm, a layer thickness of 3 mm (outer surface) or 1.5 mm (ribbing) and a printing speed of 18 mm/s (outer surface) or 25 mm/s (ribbing).

Fully Automated Trajectories

Aesthetic, robust, and comfortable seating furniture was designed thanks to good preparation and the accurateness of the robots. "Every Twine element passed the quality check executed by our software and the always vigilant eye of the camera system on our robots," Desyllas says. The AiSync software supports dynamic, multi-axis motion control of the print head with fully automated trajectory generation, along with process control and workflow monitoring for industrial 3D large format printing based on FFF (Fused Filament Fabrication).

Sofia Hagen and Lisa Hinderdael also liked the result. They sent Twine to Milan, where it captured many hearts although failing to win a prize. At the end of September, the furniture became part of the "Planted" show in the course of the London Design Festival. In the future, the Twine seating elements will be customized and produced by the Italian Kuka partner Caracol AM. (cd) ■

Info

Twine Project

The project was realized in cooperation between the HagenHinderdael creative studio, the sustainable materials supplier Reflow and Ai Build, a company that develops software and artificial intelligence, among other things for applications with Kuka robots:

https://reflowfilament.com
https://ai-build.com
www.kuka.com

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