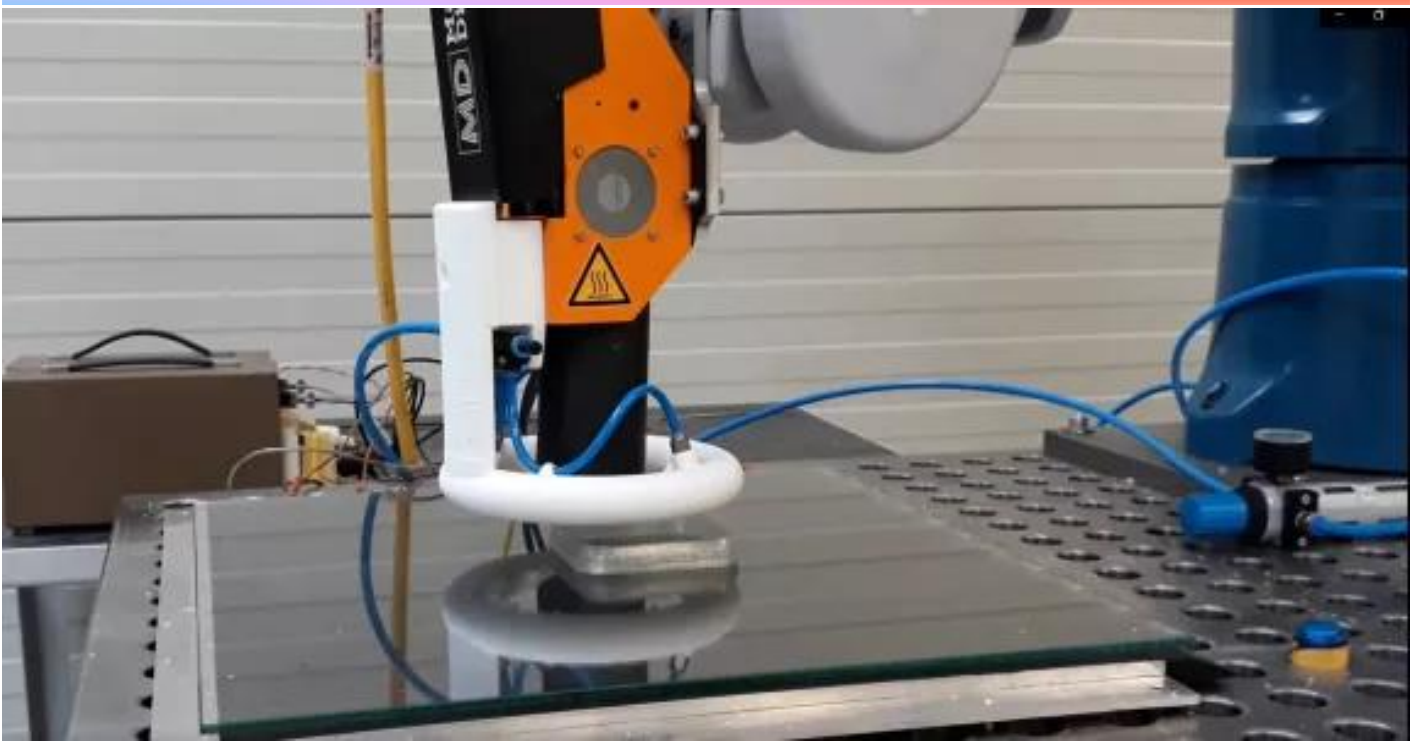




LightFunc: 3D polymer printing on metal for flexible small batch production

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The industrial sector faces fast-changing customer expectations, especially in the areas of mobility, recreational vehicles and specialised equipment. Customisation, lightweight design and reduced environmental impact are becoming key criteria. At the same time, production cycles are shortening and the demand for unique parts or small batch production is growing.

Using standard methods to combine strong materials like metal with the greater flexibility and insulating properties of polymers is far from easy. Such assemblies often rely on adhesives or mechanical fasteners, which increases costs, reduces repairability and complicates recycling. Although the adoption of hybrid solutions seems promising, from an ecological transition standpoint these constraints are becoming a major obstacle. Manufacturers are now being pushed to rethink assembly methods for increased circularity, with parts that can be dismantled, repaired and easily recycled, without any glue or screws.

LightFunc was set up to demonstrate that polymer 3D printing on textured metal can replace

traditional methods while ensuring performance and the possibility of dismantling and recycling.

LightFunc: an alliance of expertise

Sirris ran the LightFunc project in partnership with the CRM Group, which among other things is a specialist in functional metal surfaces. Drawing on its expertise in thermal spraying and texturing, CRM designed various types of metal substrates optimised for the adhesion of technical polymers. By playing with surface geometries and mechanical fixings, it developed patterns that ensure reliable assembly without the need for traditional fasteners.

Meanwhile, Sirris made use of its expertise in non-planar polymer 3D printing and multi-axis robotics. Its role was to demonstrate that it is possible to deposit technical polymers on complex metal surfaces while ensuring reliable adhesion and considerable freedom of design. By developing printing processes adapted to 3D geometries, Sirris paved the way for personalised hybrid products, produced either in small batches or individually.



From concept to demonstrator: a proven method

To validate the feasibility of the approach, the LightFunc project used a physical demonstrator: a stamped, curved and textured aluminium sheet on which 3D printing can take place. CRM developed several mechanical lattice patterns, spikes, mushrooms and H-shaped structures, generated by thermal spraying and laser cladding. Each pattern was tested and optimised in terms of geometry, density and adhesion capacity. At the same time, Sirris designed a 5-axis non-planar robotic printing process algorithm capable of accurately following complex surfaces. This approach ensured precision 3D printing, even on curved objects.

Obstacles overcome step by step

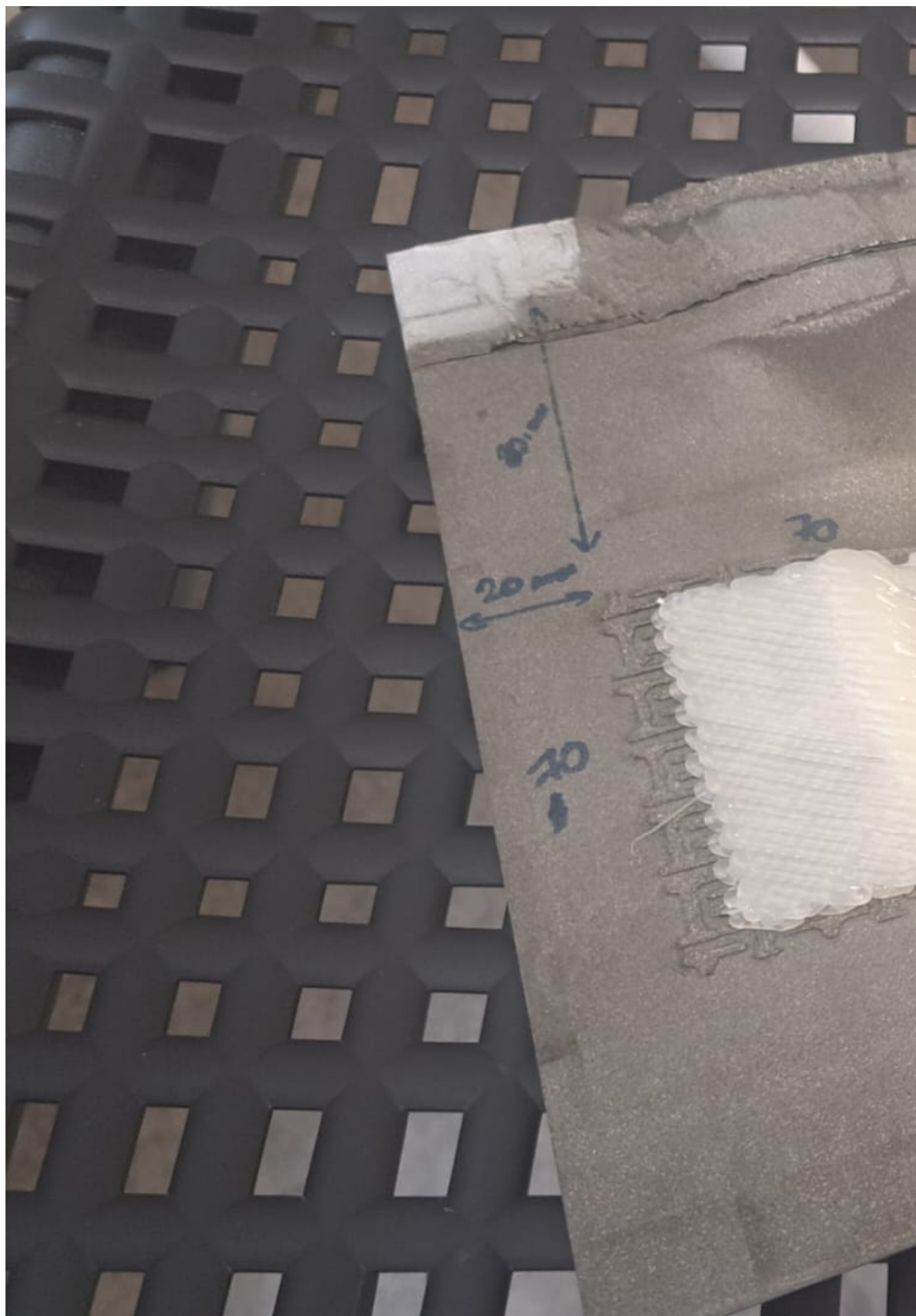
As with any industrial innovation project, LightFunc had to overcome a number of technical challenges. During the testing phases, the teams encountered problems relating to the heat-resistance of the silicone masks, the poor adhesion of certain patterns in the texturing phase and the over-extrusion of the polymer caused by speed variations during the 3D printing phase.

Each of these obstacles was resolved in successive iterations: adjusting thermal cycles, integrating cooling phases, optimising lattice patterns and improving extruder control. Interim tests gradually improved process reliability until material cohesion and reproducibility were achieved.

From prototype to final demonstrator

The project culminated in the creation of a technical demonstrator integrating all the components that had been developed. The final product combined a stamped aluminium sheet with complex geometry, a textured surface with optimised micrometric patterns and a polymer deposit produced using non-planar 3D printing.

Tensile tests confirmed the strength of the metal-polymer interface, while disassembly tests using localised heating showed that the polymer component could be removed without damaging the surface. This demonstrator proved that it is possible to produce customised hybrid pieces, without any need for glue or screws, that can be taken apart and recycled.



Gaining a new perspective: OptiComp3D

Building on the results of LightFunc, Sirris, this time in partnership with Cenaero, has launched a new project: OptiComp3D. This project aims to take the functional customisation of composites even further by exploring the use of continuous fibres and topological optimisation.

The goal is to push the boundaries of hybrid manufacturing to create even lighter, more effective and more durable parts, while reducing cycle times using advanced 3D printing techniques. There are many potential fields of application: cases for medical devices, onboard parts in transport, protective structures in robotics, and many more, all of these are cases where customisation, repairability and recycling are becoming competitive advantages.

Why is this relevant for your company?

Are you developing lightweight construction solutions, manufacturing custom components or looking to simplify your technical assemblies? LightFunc's innovations directly address these industrial challenges.

With this hybrid metal-polymer approach, you can:

- Lighten your parts while maintaining the strength of the metal,
- Reduce assembly complexity (no need for glue or screws),
- Produce small batches or single units more quickly and flexibly,
- Integrate advanced functions (fastening, damping, insulation),
- Improve repairability and recyclability thanks to removable parts.

Sirris will support you from concept to validation, with a tested and ready-to-use solution.

Conclusion

The LightFunc project demonstrates that it is now possible to functionalise hybrid metal-polymer parts reliably that can be disassembled and scaled up for industrial production. By combining metal surface texturing and non-planar multi-axis 3D printing of technical polymers, Sirris and CRM are opening a new avenue for custom small batch production, without glue or traditional fixings.

The results are already available to companies interested in using Sirris to prototype, validate or produce custom hybrid parts. And with OptiComp3D, Sirris is continuing its research to integrate reinforced materials, optimise part geometry and accelerate manufacturing cycles.

Want to go further?

Do you have a component to test, a small batch production need or an idea to test out?
Contact our expert [Didier Garray](#) for personalised support.

[Contact us](#)

Authors



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