

## 3D printing for the production of lamination forms

In cooperation with Brandenburg University of Technology Cottbus - Senftenberg, LAST and LEHVOSS Group



## Introduction

In many technical disciplines, laminated components are built with glass fibers, carbon fibers, aramid fibers or mixed fiber systems. These components are used, especially as sophisticated carbon fiber laminates, e.g. in aerospace technology, in the racing segment and boat building or in sports equipment.

The higher the requirements placed on the component, the higher the quality and functionality of the resin system used, such as polyester or epoxy resin. In particular, the resin systems differ in their chemical reactivity and the required consolidation temperatures. The selected fiber-resin combination is specific to each application and therefore places different demands on the tools used.

Additive processes make it possible to print shapes close to the contour. The cavity for the laminate can be created with the least amount of machining rework. The introduction of release agents is carried out as far as possible using classic, known techniques.

Tools manufactured in 3D printing for the lamination of prototypes / batch size 1 or small series represent a technically high-quality and economical alternative to conventional mold making, since complex and time-consuming roughing processes are replaced by near-net-shape 3D printing and the subsequent fine finishing process.

3D printing can be done as filament printing (FFF) for smaller shapes. Direct extrusion (FGF) is ideal for large to very large shapes. Here, the material is applied from plastic granulate via a small extruder. The process time is significantly reduced in the FGF compared to the FFF, as only one or two wide beads (5-15 mm) are stored as a molding tool contour.

### Special properties of LUCVOCOM® 3F - filaments and granulates for 3D printing:

- **Large product range** from PC/ABS, PA, PAHT, PET to PPS, PEEK, PEI
- Depending on the polymer, it can be used for low and high consolidation temperatures and a wide variety of resin systems
- **High strength**, especially in the layer structure (high delamination resistance)
- **Can be printed in the unheated built chambers** (note below)
- **Low warpage** thanks to special material modifications
- **Very good machinability**
- **Recyclable** (more favorable ecological balance than e.g. block foams or compact blocks)
- **Lower weight** of the tools compared to aluminum and steel

From the point of view of many users, a major advantage of the LUCVOCOM 3F product line is the possible printability in unheated printing chambers and on unheated (large-format) printing platforms. This is achieved through special material formulations. These enable very high strength values, especially in the critical Z-plane, with a very low tendency to warp, even with unreinforced and slightly reinforced materials. This combination of properties is unique in the market and enables previously impossible applications. As a result, it is possible to calculate with significantly lower investment sums on systems. This results in lower hourly machine rates and thus lower manufacturing costs. Since there is no need to work on and in hot units and no heating and cooling times have to be taken into account, this in turn reduces manufacturing costs. In addition, system loading and operation are significantly simplified.

## Application example

With the TARVO, Last produces the world's lightest carbon fiber series frame for MTB enduro use. The frame has been tested by EFBE Prüftechnik and is approved for racing.

In order to protect the particularly stressed down tube of a frame from unavoidable stone impacts in tough off-road use, a stone guard protection was provided. An ultra-light, carbon fiber-based laminate structure is used here. The component is attached to the lower end of the down tube and also runs under the bottom bracket shell. This also ensures protection of the bottom bracket shell, e.g. when placing it on stone blocks.

The heavy-duty yet lightweight design of the stone guard protection continues the lightweight construction philosophy of Last. In addition, as a replaceable wear part, the component guarantees long-term availability of the protected sports equipment.

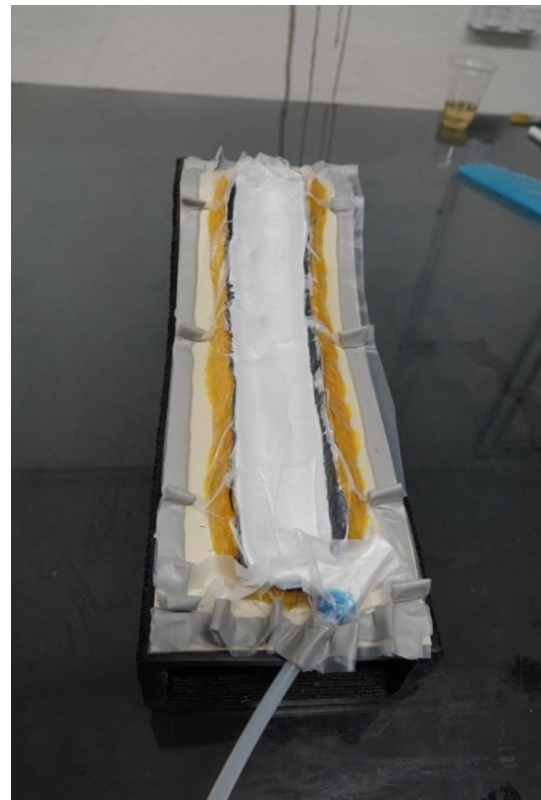
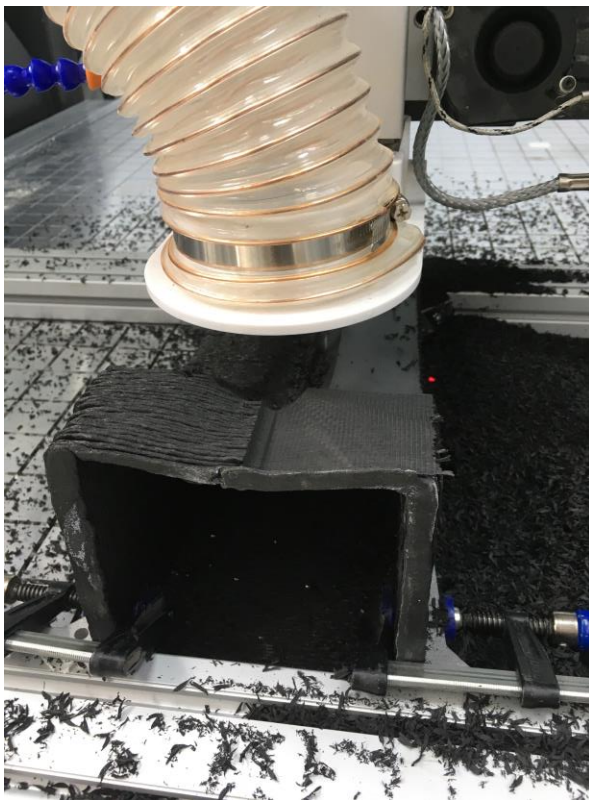


Photo left: Near net shape additively manufactured forming tool during the fine finishing process; Photo right: Vacuum-compressed laminate during consolidation



Photo: Usable mold with coated cavity. In the foreground, molded CFRP component

**About LEHVOSS Group:**

The LEHVOSS Group under the management of Lehmann&Voss&Co. is a group of companies in the chemicals sector that develops, produces and markets chemical and mineral specialties for various industrial clients. Lehmann&Voss&Co., Hamburg, was founded in 1894 as a trading company. In its success story dating back some 125 years, the owner-run company has developed into a powerful global organization – with long-standing connections to prominent suppliers and with its own production sites in Europe, the USA and Asia. For more information, please visit [www.lehvoss.de](http://www.lehvoss.de)

With its product lines LUVOSINT® and LUVOCOM® 3F, the LEHVOSS Group is offering innovative and tailor-made plastics for 3D printing. These products have been adapted to the most common production processes, such as powder bed fusion, fused filament fabrication (FFF) and direct extrusion printing processes. The materials are distinguished by their good processing characteristics and excellent material properties. <https://www.luvocom.de/en/products/3d-printing-materials/>

**About Brandenburgische Technische Universität Cottbus - Senftenberg:**

Research into lightweight construction in the field of fiber-plastic composites (FRP) is a successful research focus at the Brandenburg University of Technology Cottbus - Senftenberg. Along the product-oriented value chain, the international and interdisciplinary team in the polymer-based lightweight construction (PbL) department deals with the cross-sector development of energy-efficient lightweight construction solutions and associated manufacturing technologies.

Starting with the first idea, through the design of prototypes, to the production-related implementation of complex technology demonstrators, the focus is primarily on construction and simulation as well as on the production and testing of function-integrated FRP construction methods.

**About LAST:**

LAST is a rider-owned bike company from Germany based in the Ruhr area. Led by Jörg Heydt and Jochen Forstmann – both active mountain bikers with long-standing race experience – production and distribution of high-grade frames for mountain bikes started in 2000. The line-up ranges from hardtail and full suspension frames to complete bikes of different equipment options that can be individually customized.



**Head Office**

Lehmann&Voss&Co. KG  
 Alsterufer 19  
 20354 Hamburg  
 Germany  
 Tel +49 40 44 197 250  
 Fax +49 40 44 198 250  
 E-mail [luvocom@lehvoss.de](mailto:luvocom@lehvoss.de)

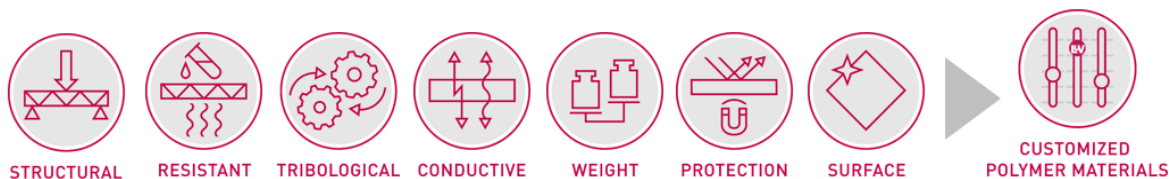
**North America**

LEHVOSS North America, LLC  
 185 South Broad Street  
 Pawcatuck, CT 06379  
 USA  
 Tel +1 855 681 3226  
 Fax +1 860 495 2047  
 E-mail [info@lehvoss.com](mailto:info@lehvoss.com)

**Asia**

LEHVOSS (Shanghai) Chemical Trading Co., Ltd.  
 Unit 4805 Maxdo Centre  
 8 Xingyi Road, Changning District  
 Shanghai 200336  
 China  
 Tel +86 21 6278 5186  
 E-mail [info@lehvoss.cn](mailto:info@lehvoss.cn)

**Our expertise in materials**



[www.luvocom.com](http://www.luvocom.com)



LUVOCOM® and LUVOSINT® are registered trademarks of Lehmann&Voss&Co. KG

Any recommendations made for use of Seller's materials are made to the best of Seller's knowledge and are based upon prior tests and experience of the Seller believed to be reliable; however, Seller does not guarantee the results to be obtained and all such recommendations are non-binding – also with regard to the protection of third party's rights –, do not constitute any representation and do not affect in any way Buyer's obligation to examine and/or test the Seller's goods with regard to their suitability for Buyer's purposes. No information given by the Seller is to be construed in any way as a guarantee regarding characteristics or duration of use, unless such information has been explicitly given as a guarantee.