



POST-PROCESSING

FOR FFF PRINTS

LEAD YOUR MARKET BY ENHANCING THE FUNCTIONAL
AND AESTHETIC PROPERTIES OF YOUR 3D PRINTS

 bigrep

POST-PROCESSING IN INDUSTRY

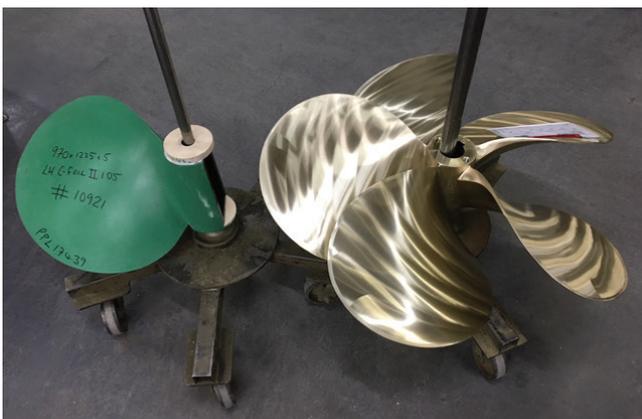
A hallmark of many leading production technologies is to combine a proven manufacturing technique with a well-chosen post-processing technique to deliver a maximum impact product. Post-processing can improve geometric and mechanical properties and creates a wowing aesthetic effect. The simple impact of gold-plating on jewelry or the iconic anodizing of the Maglite are powerful examples in end use production. Pre-treating wood used for concrete formworks with a release agent is a typical application delivering efficiency and quality benefits during production of another end use item. In each case post-processing contributes clear value.

While BigRep printers deliver awe-inspiring objects straight off the print bed, our eBooks already show industry leaders post-processing our prints to great effect. Villeroy & Boch beautifully finishes its full-sized bath prototypes by filling and then spray painting.



Furniture and Household: Villeroy & Boch, Prototyping

Teignbridge optimizes the performance of its cast propeller patterns with a coat of mold-release paint. The streamlined form of the Villa Ancora architectural model is efficiently conveyed through its matt enamel paint finish. This eBook shares insights into techniques which can be combined with our large-format FFF technology to push boundaries, delivering better products more efficiently.



Marine Industry: Teignbridge Propellers Int. Ltd, Propeller Pattern



Architecture: Villa Ancora, Modelling

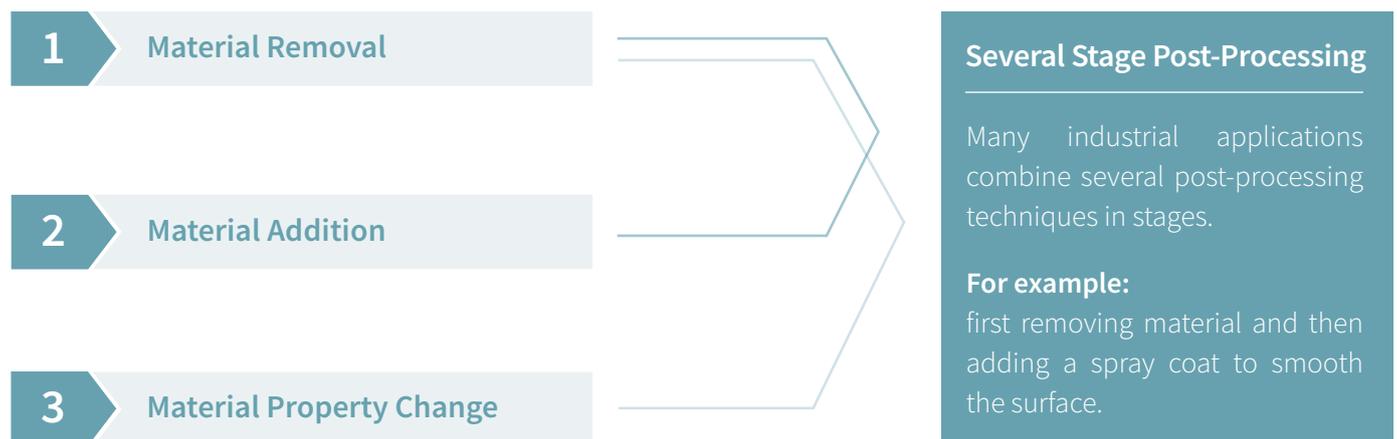
NOWLAB, the Innovation Consultancy of BigRep, offers Post Processing Consulting to help bring your prints to the next level. NOWLAB advises on adequate processing technologies for industry specific use-cases and surface requirements.

POST-PROCESSING BASICS

Post processing enhances the surface properties of prints in many aspects to deliver improved mechanical performance and aesthetic impact. By improving these key surface characteristics, post processing widely extends the range of use cases and applications across all industries.

FUNCTIONAL PROPERTIES		AESTHETIC IMPACT
<ul style="list-style-type: none">• Geometric Precision• Structural Properties• Mechanical Performance• Material Strength• Thermal/Electrical Conductivity	<ul style="list-style-type: none">• Surface Characteristics• Smoothness• Tactile Properties• Light Diffusion	<ul style="list-style-type: none">• Visual Impact• Color• Luster• Opacity/ Transparency• Patterning

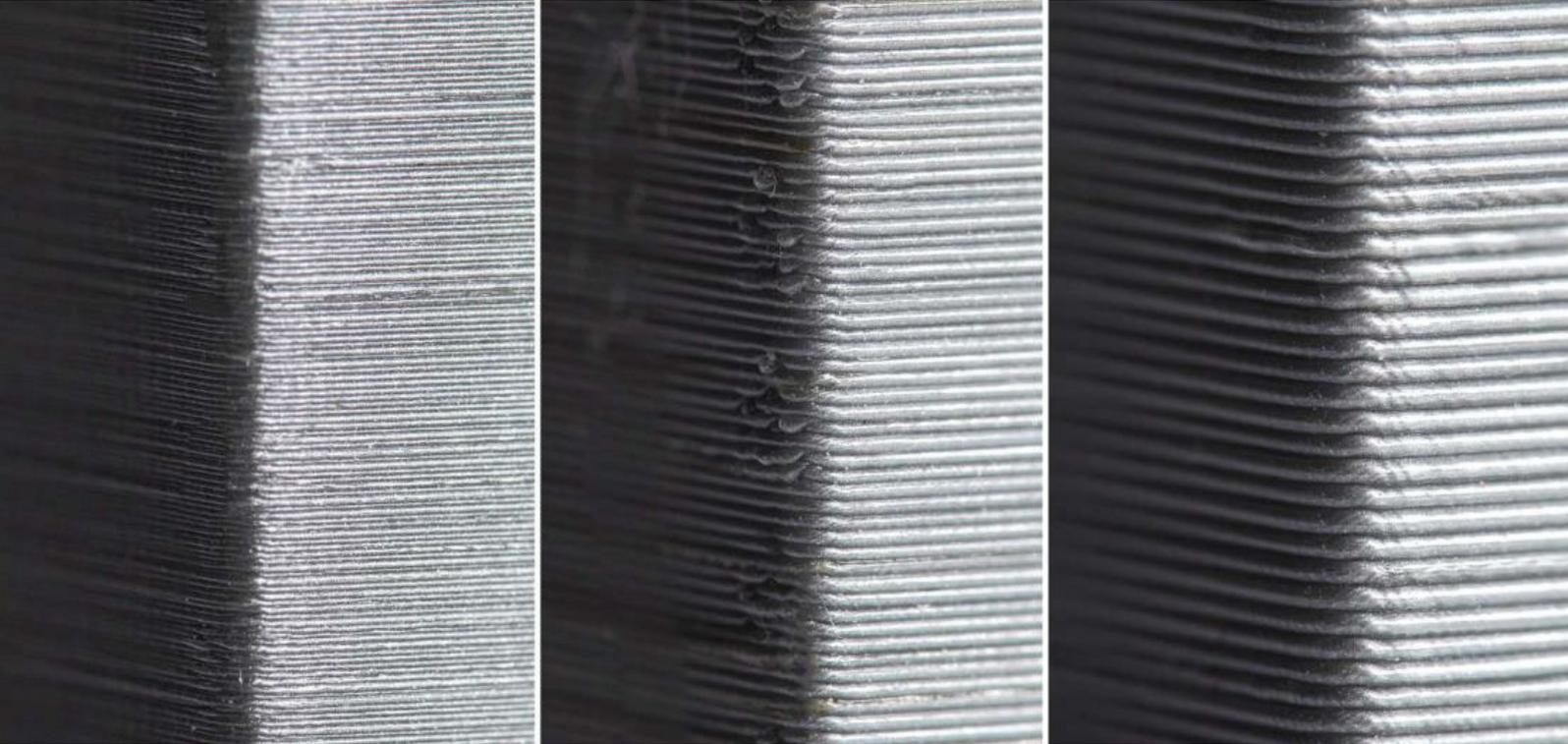
3 TYPES OF POST-PROCESSING TECHNIQUES CAN BE APPLIED TO FFF PRINTS



| SURFACE TEXTURE

STAIRCASE EFFECT

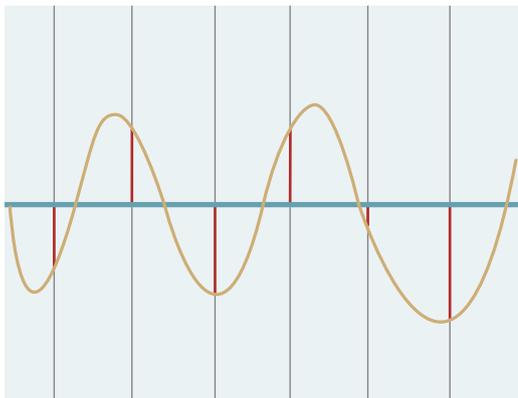
The staircase effect describes the overall print surface roughness which is indicated through the layer by layer FFF print process.



Macro View of FFF-prints at 0.05, 0.2, 0.3 mm layer heights. The layer height impacts the extent of the staircasing effect.

RA-VALUE: THE ROUGHNESS AVERAGE

The concept of Roughness Average provides a method of quantifying the surface roughness of particular objects. Roughness Average, R_a , measurements can thus be one objective indicator to compare different post-processing methods.



Surface Visualization

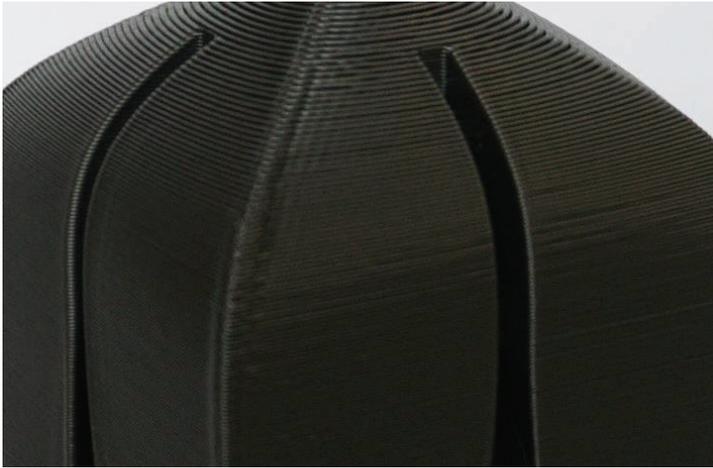
The R_a -value describes the average vertical distance between the deepest notch and the highest material accumulation.

1. ■ Average vertical distance
2. ■ Material surface
3. ■ Material distance from average value

1 MATERIAL REMOVAL

POST-PROCESSING FOR FFF

A range of material removal techniques can be used to improve FFF object surfaces. Material removal can be used as a final finish or as preparation for a subsequent additive process. Most removal techniques are mechanical while some are chemical.



Unprocessed Pro HT

Clearly visible staircase effect.



Machining

Very smooth finish achieved.

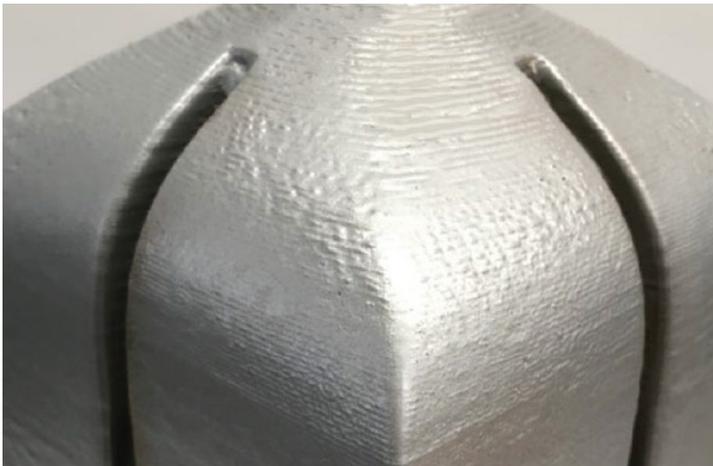


High-Resolution Tumbling

Very smooth surface finish achieved.
Adequate for highly smooth polished surfaces.

2 MATERIAL ADDITION POST-PROCESSING FOR FFF

FFF prints can be filled, coated, plated and foiled with a wide range of materials to achieve very different effects. Additive application techniques range from filling, spraying, and dipping to electro-chemical methods.



Powder Coating

Smooth surface finish.

Achievable through powder coat spray and heat treatment.



Spray Coating

Extremely smooth finish achieved through elastomeric spray coating.



Copper Plating

Very smooth and material strength improving surface through copper plating.

3 MATERIAL PROPERTY CHANGE

POST-PROCESSING FOR FFF

Rather than adding or removing material, these techniques involve the application of heat or the exposure of the print to catalysing substances, in gas or liquid form.



Vapor Smoothing

Extremely smooth surface finish achieved through chemical melting process.

HIGH RESOLUTION TUMBLING

CAR WHEEL RIM

This automotive component prototype has been tumbled so that it appears and behaves more like the final manufactured part. The tumbled part is smoother, giving a better sense of the visual and tactile aesthetics of the design as well as a more accurate form with which to undertake wind-tunnel testing. This demonstrates how post-processing can deliver designers, engineers and decision-makers valuable information to work with during the product development process. The wheel rim is a complex industrial design which was precision-printed in full scale on a BigRep ONE in just 48 hours. The tumbling process applied to the rim is a long-established, automated technique for the surface smoothing of all sorts of objects and materials. Tumbling can be done in large batches and offers a wide variety of finish options. By combining large-scale FFF printing with tumbling represent a highly efficient and flexible method of delivering large, complex, smoothed objects: a promising technique with both product development and end-use potential.



THE PROCESS



LIKELY APPLICATIONS:

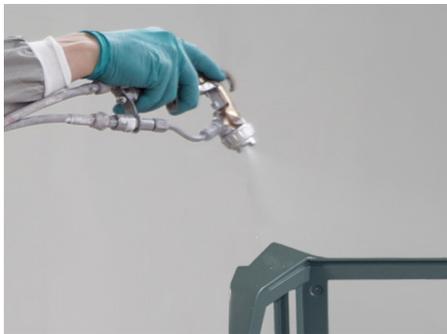
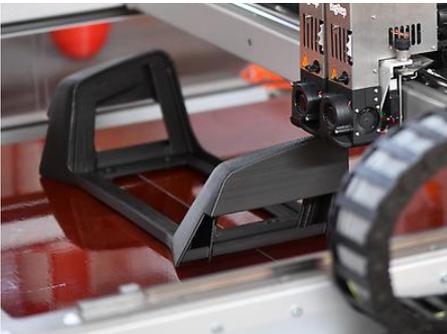
- Design and Engineering Prototypes
- Preparing End-Use parts for Additive Post-Processing
- Automotive, Product Design, Engineering

RESIN COATING HEADREST SPARE PART

This replacement part for a seat headrest from a Deutsche Bahn train was printed on a BigRep ONE and then treated with a high quality two-component resin coating. The surface smoothness, color consistency and tactile qualities achieved are impressive and it is possible that BigRep printers will be producing spare parts for Deutsche Bahn stock in the near future. Printing on-demand allows Deutsche Bahn to save significant resources which would otherwise be dedicated to warehousing and batch-production using conventional methods, while achieving performance requirements and aesthetic quality.



THE PROCESS



LIKELY APPLICATIONS:

- Aesthetically demanding End-Use Parts
- Showcase Prototypes
- Mobility, Furniture, Consumer Goods

ALUMINUM PLATING

AEROSPACE FUEL TANK

This fuel tank designed for an Unmanned Aerial Vehicle was printed on a BigRep ONE and then plated with aluminum to enable it to withstand high pressures. Currently undergoing operating pressure testing, the fuel tank will be a high performance aerospace end-use component manufactured using BigRep FFF technology.



The innovative metal-plating process applied to the tank is being developed by engineering company Polymertal. As the technique is perfected, a growing range of hybrid components will become possible to realize combining the fast production, complexity and lightness of FFF prints with the technical performance of metal parts. We expect numerous new end-use applications for hybrid components produced with BigRep technology in sectors such as aerospace, marine, automotive, and mobility.



THE PROCESS



LIKELY APPLICATIONS:

- Performance Components
- Aerospace & Automotive
- Marine & Mobility