CASE STUDY DAIMLER BUSES

3D-printed spare parts: disrupting the supply chain with a sustainable on-demand production

In the automotive industry, 3D-printing is a great opportunity to revolutionize the supply chain, replace high costs and long delivery times with a sustainable and more economical solution.
In the automotive industry, Daimler was one of the first companies to really invest in Additive Manufacturing, not only focusing on plastics but also on metal 3D-printing.

Within Daimler Buses, a Daimler subsidiary, an initial project for 3D-printed spare parts was set up in 2016. The project was to be carried out by a specially founded department, the Center of Competence 3D-printing, headed by Ralf Anderhofstadt. In the newly created CSP (Customer Services and Parts) project, 3D-printing, in this case Selective Laser Sintering (SLS) was to be tested for use in daily production for visible spare parts. The idea behind it? Nothing less than the reinvention of the supply chain for the after sales business and to improve the global spare part production.

In several workshops and with the support of various partners such as Additive Minds, EOS and DyeMansion, the entire supply chain was defined and evaluated. The result: An analysis that showed how 3D-printing could be used to its full extent. It showed the maximum added value and how quality and scalability barriers presented by traditional manufacturing methods could be eliminated.

ABOUT DAIMLER BUSES
A global player with many years of experience in AM looking for a way to revolutionize their supply chain

Switching to 3D-printing reduces costs, lead times and the complexity of the supply chain. Therefore it helps us to react faster to the needs of their customers.

Daniel Kluth, Category Buyer 3D-Printing, Daimler Buses
THE CHALLENGE
Achieving a part quality that can compete with injection molded parts

In the first attempts to use industrial 3D-printing, it turned out that the reproduction of these very parameters was difficult. The production of the parts worked well, thanks to the precision of the EOS machinery, which delivered unmatched quality, especially for complex geometries. But coming from the production those parts were white and the surface finish rough.

So there were two main challenges for Daimler Buses: On the one hand reaching the required glossy finish of the injection molded counterparts without losing textures. And on the other hand finding a coloring technology that enables reproducible coloring results and the development of corporate colors, like in this case different grey shades. It was obvious, that the printed parts were going to need several stages of post-processing.

In order to understand the complexity of the topic, one only has to bear in mind that there are well over 300,000 different spare parts for Daimler buses and trucks. This leads to a very complex, long-term and expensive supply chain. Here Daimler buses realized a need for reinvention - for a decentral, on-demand production that allows small volumes.

As one can imagine, a company like Daimler has particularly high demands on quality, especially regarding their final product. The surface quality and color of the parts had to be in no way inferior to the spare parts produced with injection molding.
After consultations, the premium automotive manufacturer found the solution in the DyeMansion Print-to-Product workflow, consisting of the blasting systems Powershot C and Powershot S and the DM60, that delivers color to white polyamide parts. Through the treatment with the PolyShot Surfacing in the Powershot S the SLS parts get their injection molded like surface. The process does not affect the part structure or geometry and saves the leather structure of the parts.

**THE SOLUTION**

A reproducible and traceable post-processing technology meeting the highest quality requirements

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**Print-to-Product workflow**

1. **CLEANING** (cycle time: 10min.)
   The excess powder is removed with the automated Powershot C system that avoids pressure marks, burn marks and powder residues.

2. **SURFACING** (cycle time: 10min.)
   The parts are treated with the proprietary PolyShot Surfacing (PSS) process in the Powershot S, which provides a scratch-resistant and dirt-repellent surface as well as a matt-glossy look.

3. **COLORING** (cycle time: 2.5h)
   With the DeepDye Coloring (DDC) in the DM60 the parts get their specially developed corporate Daimler Buses color.

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**We can now produce spare parts at scale using on-demand, 3D-printing and finishing processes that meet our technical specifications and surface quality standards.**

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Ralf Anderhofstadt, Manager Center of Competence 3D-Printing, Daimler Buses

Daimler Buses used the DyeMansion Color Matching to develop three special Daimler Buses grey shades based on the injection molded parts, which are applied to the parts with the DeepDye coloring on the DM60. In contrast to spray painting, the paint is absorbed into the component and does not form another layer on the part, which also contributes to preserving the textures. The DyeMansion technology is used on-site at the Center of Competence 3D-printing at Daimler Buses.
SUSTAINABLE ON-DEMAND PRODUCTION

Through the successful implementation of industrial 3D-printing, spare parts can now be produced on-demand when and where they are needed. No high-volume over-production, tooling costs or big stocks are required. This does not only lead to a way more sustainable supply chain, but also reduces storage costs and shortens lead times.

CUSTOMIZED CORPORATE DAIMLER COLORS

Using the original injection molded parts as color samples for the DM Color Matching, three color shades of grey were developed that achieve the same color values on EOS PA2200 as on the original parts. After the development, the individual recipes are stored and can be retrieved and ordered again and again. This is possible with every color and every physical color sample, which can be plastics, fabrics, paper or even human skin.

THE BENEFITS

- SUSTAINABLE ON-DEMAND PRODUCTION
- CUSTOMIZED CORPORATE DAIMLER COLORS
- TEXTURE PRESERVATION
- REPRODUCIBLE & TRACEABLE PROCESSES

With DyeMansions expertise we were able to develop a specific and reproducible Daimler Buses color shape for interior parts.

Daniel Kluth, Category Buyer 3D-Printing, Daimler Buses
TEXTURE PRESERVATION

For Automotive interior parts fine textures, such as leather imitations, are pretty popular. Achieving these structures with a 3D-printing software is no longer a problem, but preserving them is not easy. Abrasive surfacing processes like tumbling or coloring techniques like spray painting destroy these textures by either removing or applying material to the parts. With the DyeMansion PolyShot Surfacing, the open pores of the polymer parts are homogenized with a special blasting media. This helps to turn the spare parts into long-lasting products, without losing the parts’ texture. DeepDye Coloring works completely independently of the parts’ geometry. In the chemical reaction between material and dye, the color is drawn into the material instead of forming another layer.

REPRODUCIBLE & TRACEABLE PROCESSES

The DeepDye Coloring works with color cartridges, that can be easily insertet in the DM60. With the DeepDye Coloring, all process parameters are traceable. All defined parameters (such as batch size, color recipe or surface finish) are stored on the color cartridge using RFID chips. The corresponding reader on the DM60 reads out this information and sets the machine accordingly for the coloring. The cartridge system and the DM60 ensure stable and reproducible processes. Once the process parameters have been defined, they can be reproduced consistently wherever DyeMansion technology is used.
After the successful implementation of the technologies, it is now time to expand the project. This includes the expansion of the Center of Competence 3D-printing, the testing and production of further spare parts as well as the certification of the process with service providers in order to be able to produce higher quantities. Also the constant exchange with DyeMansion for process development and Color Matching, application consulting and new technologies will be continued.

WHAT’S NEXT

Find out more about the project in our Coffee & Cases Interview with the Center of Competence 3D-printing team: https://youtu.be/RV8eEqQ5d4

We like DyeMansion for their strong focus on the automotive industry. One example is the Automotive BlackX™, with improved light and heat resistance.

Daniel Kluth, Category Buyer 3D-Printing, Daimler Buses

WHITEPAPER: AUTOMOTIVE BLACKX™

A strong black that enables unprecedented possibilities for the use of 3D-printed polyamide components as interior parts. Automotive BlackX™ was developed according to the hot irradiation standards of ISO EN 105 B06 method 3 in three successive cycles.

CLICK HERE TO READ THE RESULTS
TRYMANSION - TRY OUR TECHNOLOGY FREE OF CHARGE

Not familiar with DyeMansion technology yet? Feel free to test our finishing and coloring solutions with your own parts. Contact us for your first, free benchmark.

YOUR SAMPLES
Send us your non-depowdered parts that were agreed with our team.

CHOOSE FINISH
Choose between PolyShot Surfacing (PSS) or VaporFuse Surfacing (VFS). Our guidelines answer open questions and help to choose the right finish.

CHOOSE COLOR
Following the surfacing process of your choice, the parts in the DM60 are dyed in your desired color. Click here for color options.

GET SAMPLES
Receive your finished parts. Delivery date depends on scope of delivery and location.

CLEANING
SURFACING
COLORING

1. Cleaning
   - Cleaning
     - Powershot C

2. Surfacing
   - Polyshot Surfacing (PSS)
     - Powershot S
   - VaporFuse Surfacing (VFS)
     - PowerFuse S

3. Coloring
   - DeepDye Coloring (DDC)
     - DM60