



# INTRODUCTION TO DYEMANSION

## WHAT IS IT AND WHAT DOES IT DO?

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It's beyond doubt that DyeMansion is transforming SLS finishing. With the technology still relatively new, we thought we'd follow-up our recent investment in it with this summary white paper, outlining everything our customers need to know - what it does, how it works, and why we use it.



# Contents

- What is DyeMansion? 3
- Limitations with SLS Finishing (that DyeMansion overcomes) 4
- The DyeMansion Solution 5&6
- Machines 7&8
- Compatibilities and Certifications 9&10
- Case Studies 11&12

## What is DyeMansion?

*DyeMansion is the German proprietor of the only fully automated, end-to-end post-processing system for 3D Printing. It began as a venture to resolve the issue of colour fading on pot-dyed printed parts.*

*The solution – an automated dyeing machine named the 'DM60' was born. This was soon followed by accompanying machines for automated cleaning and surfacing; the 'Powershot C' and the 'Powershot S'. The three together make up DyeMansion's patented "Print-to-Product" workflow.*

***LPE purchased all 3 machines, to make the entire process available for our customers. The process is designed primarily for SLS parts, which has traditionally been the process most vulnerable to surface quality issues.***

# Limitations with SLS Finishing

## (that DyeMansion overcomes)

- **Finish Quality** - Even with the finest hand-finishing and polishing, the improvement of surface quality is always limited by the powdered nature of SLS materials. The key benefits of these materials have been strength and functionality, not aesthetic appearance. The porous surface of SLS parts can cause issues at post-processing stages. When cleaning and surfacing, complete residue removal and surface evening is difficult, due to the 'peaks and valleys' on a porous surface. If parts are treated too rigorously this can erode the material, further compromising surface quality.
- **Colouring Issues** - When coloured via the traditional pot dyeing method, dyed SLS finishes can often suffer from a lack of longevity. Exposure to heat and UV light causes gradual colour fading overtime. Additionally, the porous nature of the finish means that the dye doesn't always sit homogeneously on parts. This can cause slight variations in colour shading both on individual parts and between different parts on production batches. Additionally, colour options are limited to widely-available dye solutions.
- **Time** - Hand finishing anything is time-consuming. Finishing on SLS parts traditionally means greater lead times, particularly if the parts are production batches rather than one-off prototypes or design iterations.
- **Cost** - The cost of SLS parts is traditionally increased significantly if finishing is required, due to the long hours of labour involved.

# The DyeMansion Solution

1. **Complete residue-removal** - A combination of blasting and ionising is utilized, together with continuous rotation of parts to ensure complete removal off all residue. Automated self-cleaning of the Powershot C machine keeps the process chamber in which parts are cleaned, permanently residue-free.
2. **Non-abrasive cleaning and surfacing** - The hyper-delicate nature of the blasting technology used for both cleaning and surfacing ensures parts are completely protected from any surface damage throughout the process.
3. **Homogeneous finish** - The shot-peening method used for surfacing, aligns any 'peaks and valleys' on parts for a perfectly smooth, semi-glossy surface finish. This optimises each part for complete consistency in finish when dyed.

White base material



POLYSHOT + DEEPDYE



4. **Rapid process** - The respective cycles for cleaning and surfacing take only 10 minutes each, with a capacity equal to a mid-sized build job available for each cycle. This ensures much quicker throughput and shorter lead times.
5. **Reduced costs** - The respective cycles for cleaning and surfacing take only 10 minutes each, with a capacity equal to a mid-sized build job available for each cycle. This ensures much quicker throughput and shorter lead times.
6. **Colour fastness and variety** - The patented 'DeepDye Colouring' used to dye parts has been shown in testing to be far less prone to fading than traditional dye. It's ISO-certified as heat and light resistant, as well as resistant to rubbing, washing, bleaching, & perspiration. Over 170 RAL colours are available, and colours can be custom-created to get the exact shade required.



# Machines

## **Powershot C - Cleaning**

The Powershot C features a stainless steel cabinet, containing a set of 6 blasting nozzles which shoot media onto the parts to remove powder. An ionisation unit sits beneath the nozzles, as the adjustable cyclone removes the excess powder. An air curtain hangs above the thinly-lined rotary basket, and continuously clears the basket of any remaining residue.



## **Powershot S - Surfacing**

The Powershot S has almost an identical setup as the Powershot C, but with a different form of blasting media. The shot-peening process used for surface evening utilises small beads fired onto parts by compressed air to homogenise surfaces.



## **Powershot S - Surfacing**

With the DM60, parts are loaded into a basket and a patented colour cartridge is inserted into the machine. Cartridges are selected based on the particular colour requirement, volume, material and finish parameters of the batch. The unique RFID chip on the cartridge is scanned to select the appropriate dyeing programme, and an automated dyeing process using hot water and high-pressure sets the dye evenly and permanently onto the parts.



# Compatibilities and Certifications

## Quality Management

- Certified according to ISO 9001:201

## Biocompatibility

- Cytotoxicity according to ISO Guidelines 10993-1, ISO 10993-5 & ISO 10993-121
- Skin Irritation according to ISO 10993-1, ISO/TC 194 WG 8 in reference to ISO 10993-10 & ISO 10993-122

## Food Safety

- Approved for FOOD CONTACT according to the current versions of Regulations (EU) No. 10/2011 (lastly amended by Regulation (EU) No 202/2014) & Regulation (EC) No. 1935/2004

## Colour Fastness

- RUBBING according to ISO 105-X12
- WASHING according to ISO 105-C06
- BLEACHING according to ISO 105-N01
- PERSPIRATION according to ISO 105-E04

## Scratch Resistance

- Certified according to PV3952

## Light & Heat Resistance

- Certified according to ISO 105-B06

## Statements

- AOF (ANIMAL ORIGIN FREE)
- REACH (REGISTRATION, EVALUATION, AUTHORIZATION OF CHEMICALS) - REACH Regulation EC 1907/2006
- ROHS (RESTRICTION OF HAZARDOUS SUBSTANCES) - 2011/65/EU and amendment 2015/863

# Case Studies

## HKK Bionics

### (Bionic hand orthoses)

HKK Bionics are a German company whose founder was inspired to create personalised bionic hand orthoses following the loss of hand mobility in a car crash. They utilised 3D Printing from the get-go, as each orthosis was to be designed specifically for the individual patient.

However, the orthoses featured dozens of components with complex design features. Therefore, perfect interlocking of component parts was essential to ensure maximum functionality, mobility and ease of use. The orthoses would also need to pass cytotoxicity & skin irritation tests to be usable.

Use of DyeMansion technology enabled HKK Bionics to produce consistently smooth component parts with complete surface evenness, ensuring perfect interlocking. It also allowed unlimited colour availability, enabling the company to match orthoses to the skin tone or preferred colour of the patient – all the while passing the required cytotoxicity & skin irritation tests.



## Daimler Buses (Supply chain streamlining)

Daimler Buses are a global manufacturer and supplier of buses. Storing over 300,000 different types of spare parts en masse for post-sale supply to customers across the globe was proving costly and complicated. Daimler wanted a more efficient after-sales supply chain.

3D Printing was experimented with, as this would enable Daimler to produce only parts needed on-demand, and at the optimum location. However, many of these parts were going to be visible on vehicles. They needed both the smooth, semi-glossy surface finish of traditional spare parts, and to match the colour shades of those parts with consistency and fastness.

The Polyshot surfacing process used by the DyeMansion Powershot S enabled Daimler to achieve the required finish, and (crucially) without compromise to part structure or form. The company was also able to dye spare parts in the 3 exact shades of grey they'd used previously, with the knowledge that the colour would not soon be compromised by sunlight, dampness, or time. With the help of DyeMansion, Daimler have achieved a much more efficient and sustainable spare-part supply chain. They have reduced storage and tooling costs, minimised waste, and cut lead times for customers.



1 3D-printed raw part (EOS PA2200)

2 3D-printed part, finished with the DyeMansion PolyShot Surfacing and DeepDye Coloring

3 Original, injection moulded spare part (SETRA Cover)



For more technical details on the DyeMansion machines, including machine components and past test setups, visit [www.dyemansion.com/en](http://www.dyemansion.com/en)

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