For companies in the medical field that want to meet the individual requirements of their patients, create new products and produce them in an economical way, 3D-printing is a real solution, when combined with the right finishing and coloring technology.
“Empowering Motion” is the slogan of HKK Bionics. And that’s exactly what they do. The young start-up in the medical branch, founded in May 2017 by Dominik Hepp and Tobias Knobloch in Ulm, Germany, develops active bionic hand orthosis that helps people with paralyzed hands to restore their gripping function.

Their motivation is a personal one. Dominik Hepp for instance experienced restricted mobility of his hand functions after a car accident left him with multiple injuries including both of his hands. The idea for this product came up during his studies of medical engineering at the Ulm university of Applied Science, where he also met his co-founder.

To turn this idea into a product, the two founders combined traditional orthopedic craftsmanship with groundbreaking technology, an innovative concept and state-of-the-art manufacturing. The result is the exomotion hand one, a high-tech product that gives locomotory restricted people new mobility and valuable quality of life. **Intuitive control of the orthosis and preset grip functions is provided by a sensor, highly intelligent software and impulses coming from an active muscle.**

I had a car accident that forced me to the wheelchair. I wasn’t able to use my hands – so I’ve got an idea for people in this situation.

Dominik Hepp, CEO & Co-Founder, HKK Bionics
THE CHALLENGE

Over 40 separate components combined to a tailor-made complex and movable orthosis

From the beginning, it was clear that only industrial 3D-printing, in this case selective laser sintering (SLS), would meet the requirements of HKK Bionics. The reason for this is the enormous precision of the printing process, which is required for the many small individual and precisely fitting parts. The exomotion hand one is supposed to be a lightweight, comfortable and patient-individual orthosis that can be produced in a profitable way, even in quantity one. After HKK Bionics opted for 3D-printing, there were still some hurdles to overcome.

The motorized glove with a splint consists of many different parts, like exo mechanics (1), artificial tendons (2), a splint (3), a silicon glove (4), a display (5) and a sensor (6). The parts are produced with different technologies, over 40 of them coming from a 3D-printer.

Not only that all of the parts have to interlock extremely well and therefore have to be produced with a high knowledge of production parameters. The polyamide parts that come out of the printer cannot be used for a final product, due to the rough and sensitive surface and of course the white color. The large amount of the polyamide parts used on one product is challenging: All of the parts require a homogeneous surface treatment and consistent coloring. In the end the product has to pass cytotoxicity and skin irritation tests, which sets high demands to the coloring.

"Our product consists of many different parts. Surfacing and coloring achieve equal results for every single piece."

Dominik Hepp, CEO & Co-Founder, HKK Bionics
To produce the 3D-printed parts of the exomotion hand one, HKK Bionics is working in cooperation with German 3D-printing service bureau Teufel Prototypen and DyeMansion, whose technology delivers the right surface treatment and individual colors for the parts.

Thomas Teufel, managing director of Teufel Prototypen, was enthusiastic about the exomotion hand one right from the start. “3D-printing is the perfect manufacturing strategy for this application: On the one hand, it is perfectly adapted to the patient’s body, and on the other, it offers complete freedom in the design of the non-functional parts,” he says.

From 3D-printed raw part to high-value product:

To create the patient-individual orthosis, the hand of a patient is being scanned with a 3D-scanner. The 3D-model that comes from the scanning process is then used for the creation of the single parts for the orthosis.

Using the DyeMansion Print-to-Product workflow, HKK Bionics gets a consistent part and color quality. In the future it is even conceivable that the colors of the orthosis will be developed individually for all patients, based on their skin color or favorite color.

THE SOLUTION
Homogenous surfaces and matching skin colors

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**With DyeMansion technology we are able to deliver finished and colored products that can be used in everyday life.**

Dominik Hepp, CEO & Co-Founder, HKK Bionics
MATCHING SKIN TONES

HKK Bionics quickly realized that the more discreet the orthosis was, the greater the acceptance of the aid. With the help of the DyeMansion Color Matching technology and their consultancy, a basic set-up of three different skin tones has been developed. Apart from skin tones and individually designed colors, patients are able to choose from a big range of colors, thanks to the wide range of colors offered by DyeMansion: 17 Standard Colors, 170 RAL colors, Pantone colors and more.

MATCHING SKIN TONES

THE BENEFITS

Passed tests for Cytotoxicity and Skin Irritation according to ISO norms 10993-5, 10993-12 and ISO protocol TC 194 WG 8

✓ MATCHING SKIN TONES
✓ CYTOTOXICITY & SKIN IRRITATION CERTIFIED PRODUCTS
✓ IMPROVED & HOMOGENOUS HAPTICS
✓ INDIVIDUAL QUANTITY ONE PRODUCTS

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CYTOTOXICITY & SKIN IRRITATION CERTIFIED PRODUCTS

Biocompatibility is an extremely important factor for medical devices that are worn daily in contact with the skin - especially in view of the certifications and tests that have to be passed. The DyeMansion colors passed the Cytotoxicity tests according to ISO norms 10993-5 and 10993-12 and Skin Irritation tests according to ISO protocol TC 194 WG 8 and ISO norm 10993-12 for EOS PA2200, which is used for the production of the exomotion hand one.

COLOR MATCHING

The color matching process starts with a physical color sample, which can be plastics, fabrics, paper or even human skin. First it is measured by a spectrophotometer, and then the tone is developed by using several iterations directly on the customer’s material and finish. Therefore DyeMansion chooses a selection of appropriate dyes before beginning the iterative process whereby the concentration of the dyes and additives are adjusted until the final tone is matched. The final acceptance of the color is always done by the customer directly onsite under real circumstances.

Dominik Hepp, CEO & Co-Founder, HKK Bionics

The Cytotoxicity and Skin Irritation certificates of the DyeMansion colors are helping us a lot to get the exomotion hand one CE-certified.
**IMPROVED & HOMOGENOUS HAPTICS**

Just as important as skin compatibility is the comfort for the wearer. The orthosis must fit well and must not scratch or rub against the skin. Treatment with PolyShot Surfacing (PSS) delivers a homogeneous surface quality, transforming raw SLS parts into long-lasting, finished products - without affecting the part geometry. This also helps to ensure homogenous dyeing results.

**INDIVIDUAL QUANTITY ONE PRODUCTS**

Each orthosis is developed individually for the patient. This is made possible by the use of modern technologies such as 3D-printing and the DyeMansion Print-to-Product workflow. In comparison to conventional manufacturing methods, a batch size of only one piece can be produced economically. For HKK Bionics, this means providing the patient with exactly the help he needs - in the best possible quality.

"Every orthosis in the future is going to be a quantity one product, because it always fits 100% to the patient’s anatomy."

Dominik Hepp, CEO & Co-Founder, HKK Bionics

Creation of a 3D model with the help of a hand-held scanner on-site at a medical supply store cooperating with HKK Bionics.
The Ulm-based company is now taking the final steps towards series production. This includes the finalization of the prototype, further laboratory tests and the CE-certification. After that, series production and distribution via selected medical supply stores begins. The close partnership with DyeMansion will continue to be used for the finishing and coloring of their products.

"Due to the wide range of finishing solutions, DyeMansion is not only a development partner but also a reliable supplier for the upcoming market launch."

Thomas Teufel, Managing Director, Teufel Prototypen
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.

1 CLEANING
2 SURFACING
3 COLORING

Track 1
Track 2

Cleaning
POWERSHOT C

PolyShot Surfacing (PSS)
POWERSHOT S

DeepDye Coloring (DDC)
DM60

VaporFuse Surfacing (VFS)
POWERFUSE S