

K-PROFI



Immaculate color solutions for all light and surface effects: Kai Müller and his colleagues at Rowa create

**A perfect harmony
of color, function
and process**

Special reprint

Kai Müller sums up the company's philosophy: "At the CCC+, Rowa Group develops all its customized color solutions in-house".

A single-screw extruder produces sample film with a width of 200 mm in a color specified by the customer. Product development engineer Piotr Dziejdzic inspects the product's thickness.

Bernhard Scheffold provides an insight into the business: "We are working with more than 200 active colorants, and there is a steady flow of new substances in the market."

Exploring the world of color

How to find the ideal color for plastic parts

Encyclopedia Britannica defines color as "the aspect of any object that may be described in terms of hue, lightness and saturation. In physics, color is associated specifically with electromagnetic radiation of a certain range of wavelengths visible to the human eye". But human color perception differs from individual to individual. It is also important to consider the effect of the surface texture on color perception. On a matt or grained surface, the same color will look different than on a high-gloss finish. At the Color Competence Center CCC+, Rowa Group of Pinneberg/Germany is dealing with highly complex matters.

Written by Gabriele Rzepka, Editor K-PROFI

Numerous products are defined by their color, be it the particularly stylish packaging of a cosmetic product, a car brand or a company's corporate identity – color precision is essential. The exact color must be replicated at all times, no matter the compound or the final product.

This is the area of expertise of Julia Paul, Head of the Color Competence Center: "Our team works in close cooperation with the customer to develop their ideal color solution. Often, the creative teams of OEMs tap into our expertise. We support them all the way to help them put their color ideas into practice." The CCC+ is also the perfect address for those customers who wish to replicate an existing color. "If a customer wants to ensure that a plastic component has the same color as the car's exterior, for example, we will deliver the exact replication," Julia Paul explains.

Before this highly precise result can be achieved however, a range of prerequisites needs to be met. Numerous factors affect the coloration process and interact with the color pigments – processing conditions, raw materials, additives. Kai Müller, Managing Director of the Rowa Group, explains: "In order to select the right color pigment, we must consider the exact characteristics of all basic raw materials as well as all processing parameters. Even minute changes to the compound blend can have a drastic effect on the quality of the finished product."

A first visit to the CCC+

What exactly can visitors expect to see at the CCC+? First, there is the showroom. Not surprisingly, numerous parts and sample specimens across the spectrum of the Pantone color catalogue are presented on a huge oval concrete table. Employees and experts use these samples to discuss the "ideal" color with customers. A few meters on, visitors are surprised by more color samples, which are showcased in a kind of walk-in cabinet. The showroom is illuminated by artificial daylight with a radiation distribution that is equivalent to the color temperature of 6504 Kelvin on a gray, overcast day. Julia Paul explains why: "Colors appear differently, depending on the spectrum of the incident light. It is important, therefore, to assess colors under identical light conditions." The showroom offers a variety of ideas for customers in search of inspiration. Those who have made up their minds already can bring their part or prototype along, complete with compound data. Replicating the color of a painted component involves the use of a Keyence digital microscope capable of digitizing an assessment





Julia Paul describes her job: "We help our customers put their color ideas into practice".

Photo: K-PROFI/Masbaum



Malte Jöns is responsible for material testing – not just tensile strength, but the entire range of material tests. The photo shows him during the analysis of a compound's melt flow characteristics.

Photo: K-PROFI/Masbaum



Photo: K-PROFI/Masbaum

In color assessment cabins located in the darkroom, the colorist determines the color under standard light conditions.

of the color pigments in terms of size, shape and particle size distribution. This is followed by a study based on the selected material and processing conditions to determine which new or replicate color is feasible. In this context, Julia Paul remembers one particular incidence: "A customer wanted a fluorescent color for a particular plastic scooter component. Unfortunately, this was not feasible, because sunlight would have destroyed the effect. But we were able to develop an alternative solution."

Excessive processing temperatures and their effect on pigments are also a challenge that needs to be taken into account. For high-performance plastics such as PEEK, PPE or PPS, the feasible color range is limited. Another aspect is the careful

monitoring of processing temperatures during injection molding. In this context, Kai Müller points out an additional technological development: "At the CCC+, we use Variotherm mold temperature control to deliver brilliant colors in reinforced plastics. Without Variotherm control, the same formulation with identical ingredients would most likely result in surface defects such as flow lines, streaks and an unwanted flatness."

After the desired color and the intended effects have been selected, the pigmented compound is produced on a laboratory extruder and subsequently processed on one of the many Arburg injection molding machines with clamping forces between 250 and 2,000 kN. Different molds can produce a range of sample specimens with various surface qualities, from grain to high-gloss. These are stored beside the machines. "Every year, we produce several thousand sample specimens, which undergo our color checks and inspections and are then provided to our customers for testing," Kai Müller explains. A Mimaki digital printer is available for individual labeling and marking.

A look inside the darkroom

Once the sample specimens are produced, the colorist comes into play. This highly professional job requires talent as well as training. For assessing the quality of metallic finishes, the colorist will inspect the specimen from all angles, achromatic and colored specimens are scrutinized at a 45° angle in order to evaluate the color in terms of saturation, lightness (L^*), green-red (a^*) and blue-yellow (b^*) interferences. This assessment is based on the CIELAB color space as defined by the International Commission on Illumination (CIE). The standardized color space also considers human color perception and provides a more complex description than mathematical color models such as RGB or CMYK.

Color assessment is more than a mere assignment of numerical values. It requires an evaluation of the color distance of the sample color and the stored color. These differences are defined by means of the difference values dL^* , da^* , db^* . Julia Paul knows that for color assessment, an experienced colorist is as important as any technical measuring tool: "Our experts recognize colors up to 0.5 CIELAB. Similar to people with absolute pitch, there are individuals with an extremely precise color perception." Color viewing takes place in a color assessment cabin (CAC). CACs are supplied with different light sources such as artificial daylight D65, point of sale illuminant TL84 and home illuminant A for simulating electric and UV light. CACs are installed in the company's various darkrooms. The walls are black to prevent interferences from the outside. Julia Paul emphasizes this important aspect: The walls prevent light from being reflected into the room. Even

wearing a multicolored jumper can interfere with the color perception. In order to prevent this effect, at the CCC+, we are wearing special apparel when using the darkroom."

The darkroom is also equipped with a special freezer that holds the treasures of past preparations. Several drawers reveal small sample specimens, carefully packaged and labeled. Kai Müller shares his secret: "We store every color standard for a specific compound in a freezer in the darkroom. This way, customers can come back to us for an exact copy of "their" color in a plastic compound even years later, and we can reproduce it by using these stored physical and digital standards."

Under scrutiny

After CAC viewing in the darkroom, Konica Minolta photometers are used to verify the color. Spherical geometries are assessed with CM-3700A and CM-700d devices, directional geometries with CM-2500c CT. As a student of industrial chemistry, Dorothee Schoeneich is interested in the effect of color pigments on the weathering resistance of different compounds. "I am looking at a range of influencing factors, among them for example the influence of the particle size on the final effect and color changes after weathering," Schoeneich explains.

The young woman addresses another essential module of the CCC+: the UV room. Ten units are tightly arranged in this chamber, among them an Atlas-MTS system from the Xenontest series and a Q-Lab system, type Q-Sun. Their job: Exposing colored plastic samples to weathering conditions and conducting light fastness tests. These are used to find out how the color will behave under defined conditions. The systems



For her bachelor thesis, student Dorothee Schoeneich works with spectral photometers to assess the effect of color pigments on the weathering resistance of a PMMA compound.



Photo: K-PROFI/Masbaum

After color viewing in the darkroom, the next stages of the development process are determined.

benchmark tests conducted as part of an approval process will run on for six months or longer, depending on defined cycles. Our colorists will check their progress at regular intervals.”

Weathering tests in the UV room are only part of the wide array of testing that new compound formulations are being subjected to. Injection molded sample specimens are produced for testing tensile and flexural strength, impact resistance and thermal deformation. Other tests are conducted to assess flammability, laser marking capability, Shore hardness and scratch resistance, depending on the ultimate purpose the final product. For these tests, the company produces test specimens with different surfaces or extruded film samples. Depending on the requirements, the material has to undergo long and exacting test processes.

Color expertise pooled under one roof

Rowa Group is home to color experts from across the spectrum: Rowa Lack specializes in the development of finely dispersed PVC and PMMA single pigment dispersions. These types are available as micro-powders and suitable for printing and for industrial-scale film and part coloring. Rowasol produces liquid color concentrates with corresponding dosing systems for fluid conveying directly into the machine.

in the UV room can simulate a wide range of weathering conditions. Bernhard Scheffold is Managing Director of Rowa Masterbatch, a member of Rowa Group. The scrutiny of pigments and their behavior under day-to-day conditions are his core competency: “Here at the UV room, we can create many different weathering conditions – warm and humid environments as well as dry, hot, wet or cold climates. Our systems can simulate them all.” The samples are processed according to ISO or specifically defined OEM standards. Scheffold explains: “Some

The paternoster warehouse stores all reference samples from previous productions. “A place for everything and everything in its place,” says Julia Paul.



Photo: Rowa Group

17 injection molding machines produce small and large sample specimens for color and material testing.



Managing Director Udo Wilkens emphasizes the practical benefits of liquid pigmentation: "In addition to self-coloring with single-pigment dispersions, these products allow very fast color changes or homogenous pigmentations with minimum dosing." The reusable ColorCube system facilitates the management of liquid additives. Equipped with a fast coupling system, Rowasol delivers colors in one container directly to the customers, which can be refilled after use.

Rowa Masterbatch specializes in polymer-specific masterbatch solutions. Scheffold explains: "We are working with more than 200 active colorants, and there is a steady flow of new substances in the market. Each colorant used by us requires an individual color measuring sequence." In this context, full-body coloring is the magic word. TiO₂ or carbon black are used to produce at least ten different shades from one single pigment, each with their corresponding reflectance curve. A collective database of color standards is available for all members of the Rowa Group. Rowa Group bases its color measurements on the Colibri color management system and use this system for calibration in order to find the right formulation that meets all specifications of the material in hand. The software analyzes whether the specified color is feasible for the application and if so, will calculate the right formulation at the click of a mouse.

Rowa Group's main focus lies on customized, tailor-made industrial polymers and blends made by Romira. The compounding expert delivers more than 90% of its products in the specified color and complete with tailored properties. The company's customers are predominantly from the automotive, E+E, medical engineering

and cosmetics industries. Freedom to select from a wide array of color preparations allows Romira to develop the best possible solution for the application in-house. In consultation with the customer, Romira determines the relevant requirements and specifications. According to the requirements profile, the corresponding compound is developed in close cooperation with a team of color specialists from the company group. Pigmentation, modification, optimization and new developments according to individual requirements are part of the company's daily routine. Large and small orders, test batches or silo capacities, all demands can be met.

In order to cater to all customers, Rowa Group operates a wide variety of machines and equipment. Ten co-rotating modular twin-screw extruders with screw diameters from 16 to 30 mm are used to process standard thermoplastics as well as high-temperature plastics. Three single-screw extruders with screw diameters from 22 to 30 mm and matching dies produce film with thickness levels from 30 µm to 3 mm and widths of up to 200 mm.

All machines and instruments operated in Pinneberg/Germany, i.e. Leistritz extruders, Arburg injection molding machines with ALS integration, Xenon, Sun, QUV-A UV testing equipment complete with Konica Minolta (Colibri) color measuring systems are also installed at the company's subsidiary in Croydon PA/USA. This way, all standards developed at the German facility including their technical properties and the color selected by the customer can be reproduced for the US market. Spearheaded by local CEO Dave Baglia, Rowa Inc. also uses its coloring expertise for the local development of compounds.

Kai Müller provides a short summary of the Rowa Group: “We will develop the best solution for our customers. To this end, we have pooled the collective expertise of all companies under the roof of the CCC+. During the consultancy process, we will find the best solution that meets all customer requirements, be it in the form of a compound, masterbatch, color dispersion or liquid color concentrate. Reproducible, tailor-made color solutions are our USP.” 

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On the left: The digital microscope shows the shape, size and distribution of color pigments.

On the right: Weathering tests in the UV room are indispensable. Kai Müller checks one of the test cycles.



Photo: K-PROFI/Masbaum

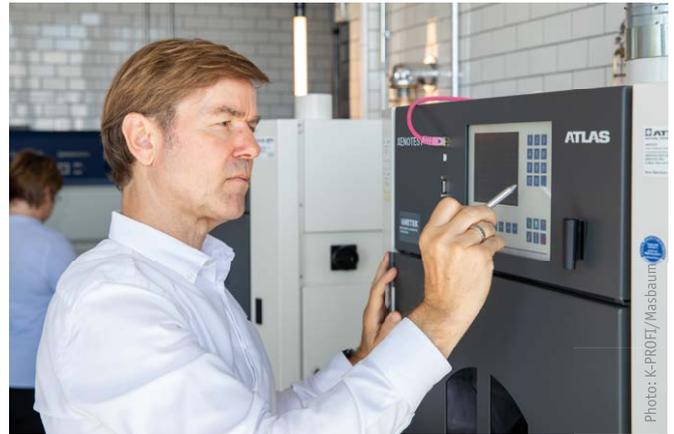


Photo: K-PROFI/Masbaum



One of ten machines is a Leistritz ZSE 27 Maxx twin-screw extruder: The system is ideal for the production of high-performance polymers such as PEEK, PPE or PPS.

Photo: Rowa Group