



## Our Laboratories

Expertise Plus Service – Worldwide





# Insight into the Technology of Our Laboratories

## Product Groups

- 6 Wetting and Dispersing Additives
- 6 Surface Additives
- 7 Defoamers
- 7 Rheological Additives
- 8 Wax Additives
- 8 Bonding Agents and Coupling Agents
- 9 Processing Additives
- 9 Viscosity Depressants

## Research & Development

- 10 Research & Development
- 12 Sustainable Product Development

## Area of Application – Coating Additives

- 14 Architectural Coatings
- 16 Dry Mix Mortars and Concrete Additives
- 18 Floor Coatings
- 20 Coil Coatings
- 22 Can Coatings
- 24 Industrial Coatings
- 26 Powder Coatings
- 28 Automotive Coatings
- 30 Wood & Furniture Coatings
- 32 Protective Coatings

## Area of Application – Plastic Additives

- 34 PVC Plastisols/Coated Fabrics
- 36 Thermoplastics
- 38 SMC/BMC
- 40 Thermosets
- 42 Advanced Composites

## Area of Application – Additives for Industrial Applications

- 44 Adhesives and Sealants
- 46 Lubricants and the Foundry Industry
- 48 Printing Inks
- 50 Inkjet Printing
- 52 Paper Coatings
- 54 Plant Protection and Agricultural Products
- 56 Household Cleaning Products, Washing and Care Products
- 58 Batteries

## Area of Application – Additives for Oil & Gas Exploration

- 60 Oil Drilling Liquids
- 62 Flow Assurance

## Service

- 64 BYK Global Regulatory Service
- 65 BYK Customer Seminars





Editorial

# Welcome to Our Laboratories!

We are a worldwide leading additives manufacturer, with varied, leading-edge testing and analysis possibilities available to customers in laboratories around the world.

We combine our extensive specialist knowledge with many years of industry expertise- and a broad portfolio of high-performance additives. These optimize the surface characteristics of coatings and plastics, and make them more resistant to corrosion or scratches. Our products can also be used in other industrial application fields such as in adhesives, household cleaning products, or in oil and gas production. We meet the increasing need for environmentally friendly and sustainable products with the largest additive range for water-based systems in the world.

Thanks to a global network of highly efficient laboratories and experienced technical experts, coupled with longstanding customer relationships, we have a deep understanding of today's market requirements as well as the challenges of tomorrow. Our range of services often saves our customers from investing in laboratory capacities, and ensures smooth integration of our additives into their individual applications.

Our customers also benefit from outstanding regulatory advice, which accompanies each of our additives. But don't take our word for it – discover for yourself the efficiency of BYK laboratories, and how we can create added value for you.

I wish you an interesting and insightful read!



Stephan Glander  
CEO of BYK

# Our Product Groups

Our portfolio consists of eight different product groups. Drawing from this, we produce tailor-made additive packages for our customers, which are precisely matched to the chemistry of their applications and the associated regulatory standards.

Our commitment to innovation means that we are already working on the products of tomorrow. With these innovations, we provide solutions to requirements that arise from new market trends, new materials, or production procedures.

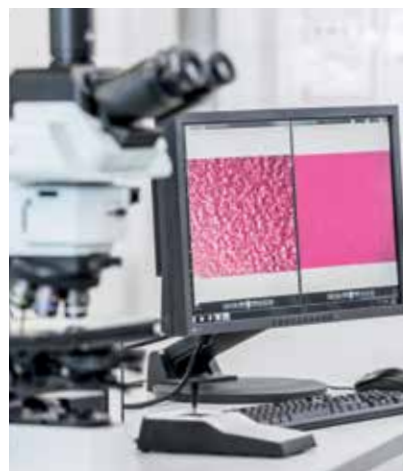
## Wetting and Dispersing Additives | **Finely and Stably Distributed**

Our wetting and dispersing additives finely distribute solids in liquids and permanently stabilize them. With these additives, you can incorporate pigments and fillers into colors, paints, coatings or plastics.

Our years of expertise in interface interaction has enabled us to refine these additives to create a comprehensive, broad product portfolio. The BYK portfolio offers a range of choices for tackling the complexity of coatings and plastics formulations.

We use a variety of technologies ranging from traditional fatty acid chemistry to specially designed acrylate copolymers with linear, but also highly branched structures. Complex structures such as comb polymers, core-shell polymers or block copolymers are also included in our technology portfolio.

We are also able to develop quick, innovative and efficient tailor-made system solutions for individual, customer-specific and regional requirements.



Microscope

## Surface Additives | **Regulating Tension, Preventing Defects**

Our surface additives are based on our expertise in interface interaction. They improve the application properties of liquids on solid substrates. While these were originally designed for coatings, today they are used in other applications.

These additives regulate the surface tension of liquids and minimize differences in the surface tension of the substrate and the coating, thereby improving wetting.

They also play a role in preventing leveling problems, floating, cratering, and other defects such as scarring that can



Contact Angle

occur during application or when drying. Overall, BYK surface additives optimize the protective function of coatings as well as their visual impression. They can also have a positive effect on the smoothness of the surfaces and make them easy to clean

Our diverse surface metrology and analytics particularly complement our portfolio, which consists of modified polysiloxanes and polyacrylates.

In conjunction with versatile application technology, we can prepare additive formulations that are perfectly suited to our customers' materials.

## Defoamers | Perfect Surfaces

Foam is more than an undesirable side effect when processing liquids. It jeopardizes the function of colors, paints and other coatings. If small bubbles form during processing, these can cause tiny craters which turn into defects and negatively impact the protective function of the coating. Our defoamers and air release agents prevent this process, by destroying the foam lamellae. This ensures flawless surfaces.

Originally developed for colors and coatings, these additives now optimize the properties of numerous other products. These applications include, for example, inks for inkjet printing, lubricating greases and cleaning agents.



Air Release Agents

Depending on the application, our defoamers are based on silicones, mineral oil or polymers. They are suitable for solvent-borne, water-based and solvent-free systems. When selecting the respective suitable additive, the chemical composition of the application and the application technique (paintbrush, roller, etc) of the subsequent application also play key roles.

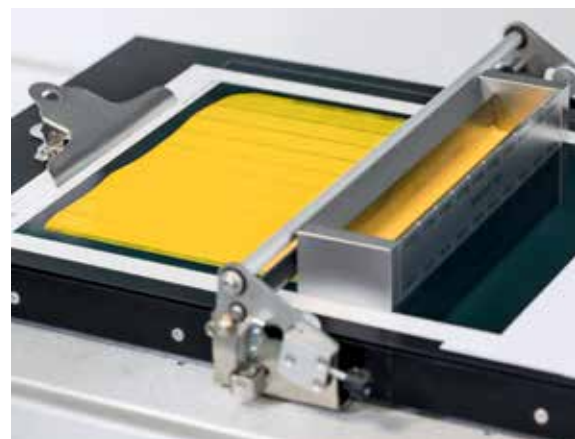
## Rheology Additives | Adjusting Flow Properties

Rheology additives control the flow behavior of the most varied of liquids. They adjust the processing viscosity of colors and coatings as well as household products or liquid raw materials that are used to produce plastics. Gas and oil production is also a typical application area. Another key advantage is that rheology additives improve storage stability by preventing the settling of solid components as well as separation and phase separation.

We employ different, complementary technologies to serve the requirements

of aqueous and polar as well as solvent-borne and non-polar systems. Our product portfolio includes liquid and powder additives based on ureas, amides and polyurethanes, as well as naturally and organically modified phyllosilicates.

We focus on solutions for increasingly complex systems against the backdrop of constantly growing market requirements. Our emphasis here is on colors, coatings and plastics, but barrier effects and plastic compounds also play an important role.



Automatic Film Applicator

## Wax Additives | **Tailor-Made Gloss and Smoothness**

Wax additives change the properties of surfaces. As needed, they can influence gloss or matting, or, for example, adjust the slip or slip resistance. As process additives, they influence the processability and accelerate industrial production processes. Our portfolio is ideal for aqueous, solvent-borne and solvent-free systems.

Alongside natural waxes, we also use predominantly semi-synthetic or synthetic waxes as raw materials. The choice of raw material depends significantly on the respective property profile of the substrates. In this way, we tailor our additive formulations precisely to the systems of our customers. In doing so, regulatory requirements with related to



Abrasion Testing with the Wazau Device

food contact or environmental protection (EU Ecolabel) play an increasingly significant role.

## Adhesion Promoters and Coupling Agents | **Strong Bond, Ultimate Stability**



Dynamic Testing Machine

Adhesion promoters and coupling agents create stable connections between interfaces. They can optimize coatings as well as plastics. The same additive can often be used in both applications – with differing results.

In coatings, our additives support adhesion to the substrate and increase the efficiency of moisture and corrosion protection.

In plastics applications, coupling agents improve the mechanical properties and the resilience of the materials. They provide improved cohesion between the resin matrix, and the particular fillers or fiber materials contained within it.

The SCONA plastic modifiers, which are based on a patented procedure for solid-phase grafting, also belong to the coupling agents product group. They improve fiber-reinforced plastics or wood-plastic compounds (WPC) by stably incorporating the reinforced fillers in the polymer matrix, and significantly increasing the mechanical properties of the composites.



## Process Additives | Advantages for the Entire Value Chain

Our tailor-made process additives support plastics manufacturers and processors when processing all standard plastics, like PVC, thermoplastic compounds or thermoset systems. In all cases, our additives provide significant help in many of the work steps.

The applications are particularly versatile, and aligned with respective manufacturing processes. For example, thanks to improved fiber wetting, process additives reduce the infusion time in applications such as RTM or VARI, and simultaneously improve the quality of the component. In the SMC/BMC area, process additives are used to improve release while increasing the process



Process Additives Press

safety. The rheological control of two-component systems is another application field.

Process additives for thermoplastic applications can be used for VOC or odor reduction.

## Viscosity Depressants | Optimized Flow Behavior

Viscosity depressants improve the flow behavior of PVC plastisols across the entire processing area. For example, they prevent drop formation, ensure better substrate wetting, facilitating the processing of the material while also optimizing the properties and costs of the end products.

The portfolio consists of four product groups, including the multifunctional additives that combine several effects, such as the DISPERPLAST and BYK-1160 families as well as the VISCOBYK-4000

and 5000 series. The VISCOBYK-5000 series consists, in part, of renewable raw materials and is low in emissions. The product groups differentiate between the various shear rates and can be used in filled and unfilled systems.

We create individual additive packages for our customers which enables them to control individual or multiple phases of the plastisol manufacturing. These include mixing, pumping, processing and storing.



Haake Viscosity Depressant

A detailed view of an Automatic Mini Plant System, a laboratory instrument used for the development of new additives. The system features a central glass reaction vessel with a stirrer, surrounded by various glass components and a complex metal frame. A large glass funnel is positioned on the left, and a red cap is visible at the top. The entire setup is mounted on a base with several white rectangular blocks.

The **Automatic Mini Plant System**, which can also be equipped with online analytics, supports the scale-up process that is used when developing new additives.

# Added Value for Our Customers

Our innovations are efficient, fast and aim to create added value for our customers and their products and applications.

While the Research & Development specialists in our three technology groups and biotechnology work on new additives, the Technology and Product Transfer team works with experts from production to ensure a fast and smooth implementation

into marketable products. These are characterized by innovative properties, and comply with the respective regulatory standards of markets throughout the world.

Experimental design supported by the design of experiments (DoE) method helps to accelerate the development process. They ensure the high reproducibility of our test results. Automated laboratory reactors and the use of state-of-the-art procedures and technologies represent another key component of our innovative strength.

In addition to our global research locations, we operate a laboratory in Amagasaki, Japan, specifically for our customers in the electronics industry. In this laboratory we develop and adapt additives for flat panel display (FPD) applications.

■ BYK supports the **Global Product Strategy (GPS)** of the International Council of Chemical Associations (ICCA) and the **Responsible Care Initiative** of the European Chemical Industry Council (CEPIC).



Reaction Mixing Pump



Optimax

## Our Three Technology Groups

Wetting & Dispersing

Rheology

Surface





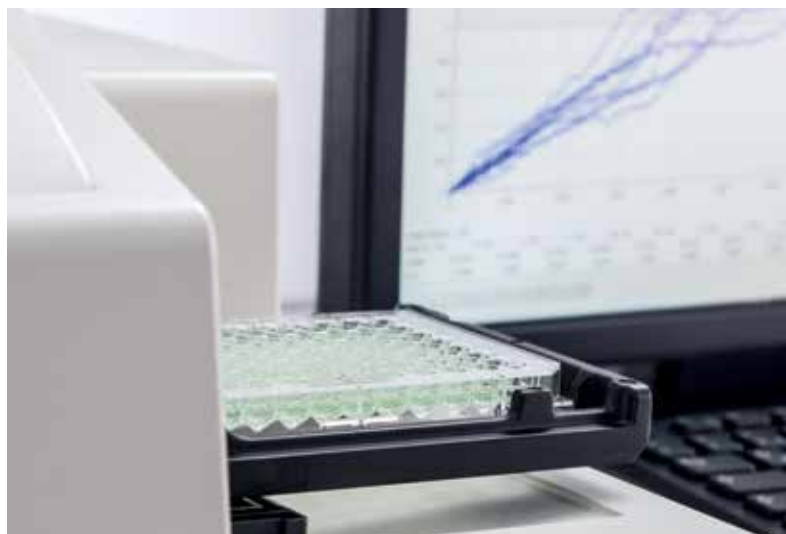
# Biotechnology: Efficient and Environmentally Friendly

BYK also works on bio-additives, bio-syntheses, and bio-effects. We have developed our own, ultra-modern biotechnology laboratory.

This is where we test the properties of substances from renewable raw materials: Do they have special characteristics that can be used to enhance of our additives? We also test enzymes for their suitability as catalysts in the synthesis of our additives. If they work at lower temperatures than standard catalysts, that could save energy in production. As a replacement for metal catalysts, enzymes can reduce toxicological side effects. Moreover, we test to see how BYK additives influence the enzymes or microorganisms that our customers use. This way, we ensure that our formulations do not negatively impact the desired outcome.

The testing procedures in our biotechnology laboratory are state of the art. They help us to work efficiently, save materials and support our commitment to sustainability.

The laboratory equipment includes a pipetting robot, a 3D printer, and a high-throughput spectrophotometer. The robot saves time as it can prepare 96 samples within minutes. This way, we can test different substances or differing formulations simultaneously. With the 3D printer, we can produce test objects in smaller sizes. When testing bio-additives, these replace the conventional 50 x 30 cm panels, reducing material consumption.



Spectrophotometer

To observe the effect of our additives on biomolecules, we use the spectrophotometer. With this, we can measure the creation or decomposition of a molecule using the light transmission of the reaction fluid. Alternatively, the molecular changes during synthesis are made visible by the near-infrared light of our NIR probes.



NIR Probe



## Our Additive Recommendation:

The following additives are based on biotechnology: CERAFLOUR 1000, BYK-3565



# 96

material samples can be prepared by the high-throughput pipetting robot in minutes. This saves time-consuming preparations and makes it possible for us to test different substances or formulations at the same time.



# Practical Tests for Valid Results

Valid additive recommendations must be relevant to the applications. That's why we test our additives for architectural coatings in our customers' formulations under conditions that are as close as possible to those in practice.

Only when we understand how the end products will behave in specific applications, are we able to provide our customers with reliable advice. Test results should be reproducible in order to make sound statements about the effect of our additives in the respective colors and coatings. That's why our equipment includes brushes, rollers and spray guns.

The range of additives for architectural coatings is diverse and includes wetting and dispersing agents, defoamers, rheology and surface additives and our specially developed formulations for multi-colored coatings. We use versatile test procedures to replicate various loads as realistically as possible. This results in objective measurements used to precisely document the effects of our additives.

For example, we use a draw-down test to give us an accurate picture of the processing and leveling quality of the coatings that we have previously adjusted with rheology additives. The optimum leveling of the coating is what creates an exceptional aesthetic result.



Multi-colored Coating



Foam Roller



Leveling Doctor Blade



Rub-out



## Regulatory Information:

Many of our additives for aqueous systems fulfill the requirements of the EU Ecolabel. Some of these even correspond to the food contact legal status of the EU and the FDA.



The **Airless Process** is a reliable application method for applying greater layer thicknesses over large expanses. As a result of this process, our defoamers prevent the development of disruptive micro-foam making the procedure more efficient.



#### Did you know ...

... our additives based on patented phyllosilicates improve color paste acceptance, processability and rheology?



## The **8-channel Ultrasound Measuring System**

is a non-destructive measuring method for representing the influence of additives on cement hydration. As a result of this method, construction formulations can be characterized and optimized in view of their setting behavior and strength development.







Flow Cone Test



Measuring Bending Fracture Strength



Hägermann Vibrating Table

# Added Value for Dry Mortars and Concrete Additives

Construction formulations such as plasters, adhesives or free-flowing floor coatings have many unique characteristics, yet it is not always possible to detect the formulation differences with the naked eye. Only when the trowel is pulled across the concrete or the plastering machine is used that the flaws of many construction products come to light.

The use of additives makes a difference. They enhance the processing characteristics as well as the functionality of the construction formulations.

For example, by using rheology additives, it is possible to selectively adjust the thixotropic or pseudoplastic properties of the respective construction formulation. We use the Hägermann table to determine the flow spread, the consistency, and the water requirements, and as a result, the impact of our additives on the rheological properties of plasters and mortars. In the case of self-leveling compounds, however, we use a delivery cylinder to establish the flow.

Wetting and dispersing agents can help to facilitate the integration of fillers and pigments. They reduce the viscosity and enable a greater degree of filling. The group of defoamers supports the developer in controlling the air void content and optimizing the leveling and surface properties.

■ We recommend our **powdered defoamers** for low-emission construction products in accordance with EC1 Plus.

The previously mentioned additive groups can also help to control the hardening properties as well as the final strengths of various construction formulations. Each construction formulation – whether plaster, adhesive or leveling compound – must fulfill specific compression or flexural strength requirements. We determine whether and how our additives influence these parameters using our compression-flexural strength machine. Our pull off tester is used for tile adhesive production.



## Raw Materials:

Our product portfolio offers a varied selection of liquid and powder additives, and fulfills regulatory requirements.



## Our Testing Proves these Floors Can Withstand Anything

Floors in industrial buildings, laboratories or parking areas are subjected to considerable stresses. They often have to fulfill many requirements, as their surfaces must withstand the heaviest of mechanical loads, be chemically resistant and virtually emission-free.

These requirements are met only by selecting the most suitable additives. Our rheology additives and defoamers support an uncomplicated, blister-free processing of thick-layered highly viscous systems – thus preventing the formation of foam bubbles or “pinholes”. When our wetting and dispersing additives are used, a stable distribution of the pigments is achieved, even when the compound is poured. Our surface additives ensure scratch resistance and resilience by controlling the surface tension. Many of our products comply with the necessary regulatory requirements.



## Just like Everyday Life

The spiked roller is used to release air in the freshly applied, still wet floor covering. We reproduce this final work step in the laboratory.

Defoamer Testing



### Raw Materials:

Our portfolio offers a broad selection of silicone- and aromatic-free additives. Our VOC-free products fulfill regulatory requirements.



Dry Sample



Gel Timer



Application with a Scraper

### Tip:

Our additive recommendations for epoxy coatings: BYK-1796 and DISPERBYK-2152

We determine which additives suit our customer's formulations by completing various, realistic tests. These include, for example, a dissolver with adjustable vacuum system.

We measure the course of the hardening using a gel timer. For air release, we rely on tried-and-tested methods such as using a spiked roller to tackle foam bubbles in the freshly laid floor covering.



## Answers to Burning Questions

The coil oven can reach temperatures of up to 400 °C. We use it to test the behavior of our additives in relation to the extremely short baking times and peak metal temperatures of coil coatings.



# Realistic Tests Save Time and Expense

Coil coating systems are usually very large. However, our knowledge of the relevant processes and our practical test methods means that we can simulate and precisely replicate the coil coating procedures in the laboratory. The results achieved can then be transferred directly to the industrial application.



Placing a Board in the Oven

The realistic reduction and simplification of our customers' production processes in the manufacturing industry form the basis of our research for new and optimized coating additives – and enable us to respond quickly to customer problems.

The baking oven in BYK's coil coatings laboratory enables us to comply with our customer's production parameters, such as peak metal temperatures, and the precise baking time.

The rationalization and optimization potential of products and processes can be established at the laboratory stage, reducing time-consuming and costly test runs by the customer.



Coating Application on a Sheet

As a result of our testing, customers receive product and dosage suggestions, starter formulations and samples that they can easily reproduce.



## Raw Materials:

Our portfolio is tailored to all conventional coil coating systems: solvent-borne, aqueous, radiation-curable and PVC plastisols.

## Tip:

We use our tests as a basis to develop precise dosage suggestions for customer formulations.

# Increase the Surface Quality Using Additive Packages

Can coatings must fulfill numerous demands. On the inside of the can, they form a protective coating between the metallic can wall and the contents. On the outside, through improved scratch resistance and abrasion resistance, they protect the can from damage during transportation and storage.

Can coatings are both decorative and functional. It is the coating that enables the production of cans and ensures their formability. Our additives help to fulfill these requirements.

When new production developments are made, we test the efficiency of our additives in a variety of coating systems. As a result, we can make individual recommendations for every application.

By using targeted additive packages, the quality of a can coating can be significantly increased; and by illustrating its efficiency in the form of different market-typical test methods,

we can provide customers with the best recommendation. In the many applications, our additives are required to be food contact compliant, and products are selected on this basis.



## Regulatory Information:

Our additive packages for can coatings comply with FDA guidelines and fulfill EU and other national guidelines.

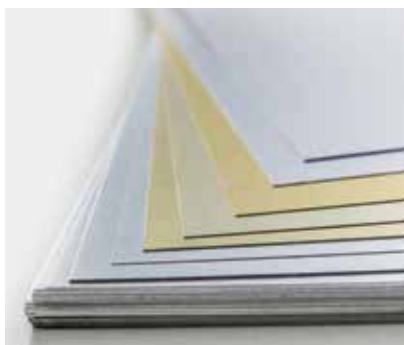


Scratch Test

The measurement of the surface slip is a fundamental test. Here, the coefficient of friction (COF) is established by applying a defined weight at a defined speed across the coating surface. Measuring the COF means that we can assess the efficiency of wax additives and silicones in the coating.

The Clemen scratch test establishes the scratch resistance of a coating. The harder and more scratch resistant a coating, the more durable and tougher the subsequent can.

Can coatings are also used as sealing lacquer, such as in a yogurt cup. Here, the coated inside of the flexible aluminum lid is quickly adhered and sealed to the plastic pot by means of pressure and temperature. Wax additives from BYK can influence the required seal strength. To check this property, we use a hot sealing bench.



Sheets



## Our Additive Recommendation:

BYK-3760 is the first in a new series of surface additives in which the majority of the cyclic siloxanes (D4-D6) is removed in the last production step.

## Smooth Gliding

We use the mobility tester to simulate the stresses to which the can coatings are subjected. By means of the COF (coefficient of friction), we discover which of our surface additives will best suit the customer's formulation.



## Application of coating specimens with the **Coating Machine:**

Which additive and which dosage is ideal?  
To answer these questions, we use specimens  
with the coating machine – fast and always  
under the same conditions.







Pigment Grinding with the Dispermat



Cross-cut Test to Determine Adhesion



Pigment Charge Measurement under the Microscope

## Different Requirements Always the Right Solution

The spectrum of applications for industrial coatings is vast. It ranges from agricultural commercial vehicles to coatings for smart phones, from washing machines to glass.

Our additives optimize the coating of all these products. It is necessary to specifically define the most suitable additives for each application. Depending on the application, the criteria might change – for example the mechanical resilience, the visual impression or the flexibility might be key criteria. We use state-of-the-art measuring and analysis equipment to determine which of our additives has the respective optimum effect for each of the applications in question.

We use this testing as a basis for recommendations on wetting and dispersing additives, surface additives, defoamers, rheology agents and adhesion promoters. Through this testing, we can arrive at precise information about the correct dosage.

The Dispermat is an important aid in producing different pigment grinds. It simulates the mills used in production, while requiring considerably less material.

The painting machine is used to vary the different parameters during spray applications. This allows us to demonstrate the effects of our additives in a reproducible manner and use a variety of paint formulations at the touch of a button. We

test key areas to determine the quality of our additives such as how they influence the gloss and leveling of a surface and how do they increase its resilience?

To do this, we test parameters including the distribution of the pigments in the coating layer in order to exclude flocculation. Our special microscope enables us to measure the pigment charge in liquid solvent-borne coatings. The pigment charge, which can be influenced by our wetting and dispersing additives, has a significant impact on the color stability of pigment blends. Additionally, the microscope enables us to analyze coating defects such as cratering.

The scratch and abrasion resistance of coatings is of great importance in many sectors. Tests are conducted to observe how coatings are affected when they rub against materials or paper. This can simulate the abrasion behavior of cell-phones in pockets, or the wear of a finish on a cabinet door. We can test for this too, and can then prove the positive effects of our surface additives.



### Our Additive Recommendation:

Our versatile wax and surface additives enable good haptics with a soft-feel effect, scratch-proof surfaces and easy-to-clean effects.

# The Best Choice for Complex Processes

Since powder coatings are free of any solvents, they are very environmentally friendly and are gaining popularity in many industries.

These are applied by electrostatically charging powder coating particles in special spray guns. Modern coating machines can achieve a yield of more than 95 percent of the powder coating on the work piece. Then, coating is then melted in a baking oven, become a scratch-free, shiny surface with good leveling.

Changes in the quality of the raw materials, formulations or even production procedures can easily lead to quality defects in the coating powder. The production and processing of powder coatings is complex and involves pre-mixing, extruding, breaking into pieces, grinding, sieving, spraying and cross-linking. It is important that everything works together – the formulation, the production and the processing –, to achieve the right end product. Whether transparent or opaque, very glossy or matte, smooth-running or structured, it is always a question of selecting the correct additive. This is where our expertise and laboratory service play a key role for powder coatings producers.

Extruding is an important core process in the manufacture of powder coatings. The pre-mixed material that is filled into the extruder already contains everything that is critical for the subsequent properties of the powder coating. At around 100 °C, the solid recipe components (pigments, fillers and additives) are optimally mechanically broken down and homogeneously incorporated into the melted binder. The extrudate



Application Using a Powder Spray Gun

experiences extreme shear as it passes between the screws and walls of the extruder. To guarantee the intended optical (color and gloss) and mechanical (impact resistance and elasticity) properties, the extruding process needs to be flawless. After leaving the extruder, the finished extrudate is immediately rolled out between cylinders, cooled down to room temperature and broken into chips.

In our powder coatings laboratory we can reproduce every process step from premixing to coating of the powder coating, in order to recommend the perfect additive for your application. We work directly with our customers, to find solutions to problems – both with standard formulations, and with new developments that enable our customers to tap into new markets. The employees in our powder coatings laboratory embody BYK's philosophy that the customer is our most important partner.



Raw Materials Mix:  
Powder Coating Chips  
and the Resulting  
Coating after Grinding

## Tip:

Our recommendation for structuring surfaces: You can achieve the most varied of effects using the CERAFLOUR family– from matte to silky gloss to a hammered effect.



## Extruding

is the most important process in powder coating production. By replicating it with our additives, we can make precise statements about the behavior of our products in the customer's applications.



# The Entire Range of Coating Procedures in One Laboratory

Automotive coatings must fulfill the most varied of functions. Aesthetics are just as important as protection against weathering and other stresses.

Depending on the function of the coating, our customers use a variety of application methods. We strive to replicate the entire range of coating procedures that are currently used in the automotive industry on a laboratory scale in order to best support our customers.

For example, we have our own ESTA (electrostatic spraying application) equipment which produces an efficient coating, just like in industrial practice. It enables us to reproduce coating programs in a realistic manner in accordance with the manufacturer's instructions, and test the effect of our additives in customer formulations. Because we closely reproduce the latest application procedures, we achieve the results our clients require.

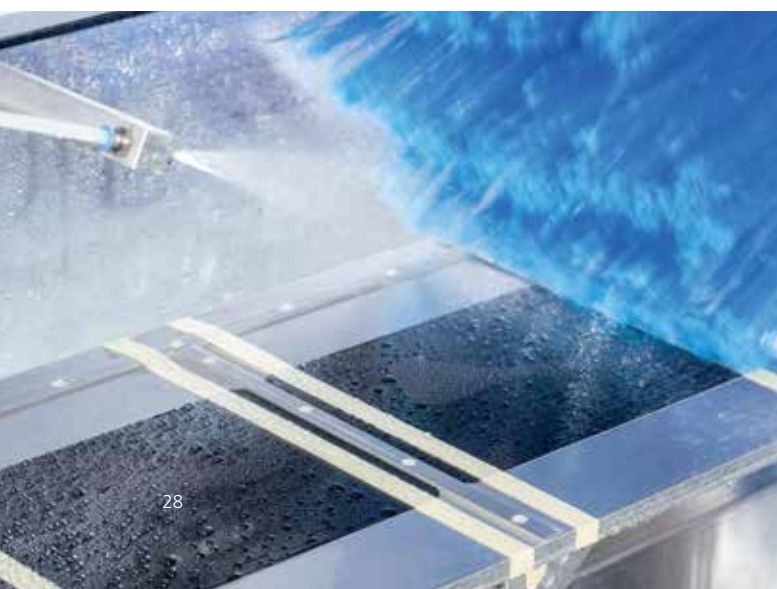
In addition, we use our CDP unit to check the behavior of our additives in the cathodic dip coating. The CDP unit uses an electric field to apply a coating to a metal sheet. In doing so, the coating is applied directly to the phosphated metal substrate during the dipping process. The application of coatings for aircraft or passenger trains can also be replicated in our laboratory. We use spray guns to simulate the spraying procedures which are standard in the industry.



Cathodic Dip Coating



Spray Guns



## Tip:

VOC-free additives improve the environmental properties of coating systems.

Car Wash Test





**40,000** rpm is the speed of the high-speed rotational bell in our ESTA (electrostatic application) plant. We use it to replicate the coating programs of automotive manufacturers.


We use various tests to control parameters such as leveling and the orientation of effect pigments and adhesion, round off our test arsenal. This also includes our car wash test – a laboratory facility which we use to replicate the conditions in a car wash.

These versatile procedures allow us to solve specific issues. By working in close collaboration with our customers, we help them formulate their coating.



#### **Our Recommendation for Effect Coatings:**

AQUATIX and LAPONITE additives optimize the orientation of effect pigments in aqueous coatings.



The most efficient way to coat wood is in a **Curtain Coater.** Wood is drawn through a curtain of liquid coating on a conveyor belt or calendar rolls. Only when our additives can tolerate the stresses of this application procedure do we consider them suitable for wood coatings.

# Protection and Shine for Various Types of Wood

Wood is a natural material that comes in many variations. There are differences between tree species, within the same tree species and based on regional origins.



Various Types of Wood

BYK maintains global expertise regarding requirements posed by different types of wood. As a result, we can offer specific regional products, as in China, where we also have research laboratories.

High gloss or matte systems still play a leading role in traditional industrial wood coatings. In addition to spraying and rolling, they can be applied using the curtain coating process. Alongside the protective function of the coatings, visual

requirements play a significant role too. New technologies – such as aqueous and UV-curable coating variants – are set to dominate the stage in the future.

The wealth of requirements is reflected in BYK's long-standing development of highly specialized, optimized coating additives. Our employees' expertise and the practical technical equipment in our service laboratories enable us to create new solutions for our customers' requirements. When combined with tailor-made BYK additives, high-quality and innovative furniture and parquet varnishes benefit from improved wetting of the most varied of woods, optimized leveling of the coating without air entrapment, greater scratch resistance, adjustable surface slip, and perfected matting control.



UV-curing Unit



## Our Additive Recommendation:

Due to the lack of volatile matter, radiation-curable coating systems, which are quick to harden and are solvent-free or low in solvents, have a very low or even no film shrinkage. This makes the matting of these systems extremely difficult. BYK offers additives which enable the increased use of matting agents in the application technology, without influencing the coating properties.

# Long-term Corrosion Protection Thanks to Efficient Test Procedures

To know whether corrosion protection via coating works for steel construction, the coating must be subjected to wind and other weather. Reliable statements regarding fire protection are only possible if the coating is subjected, at least once, to fire.



Salt Spray Test



Condensation Water Test



Fire Protection Test

For that reason, we attempt to simulate these conditions in the laboratory in accordance with precise guidelines and using the respective standards as a basis. For example, we may need to work within the guidelines of EN ISO 12944, which defines corrosivity categories and specifies the loads that coatings for steel constructions must be able to bear.

The test methods and equipment that we use to measure the effects of our additives on protective coatings and ship paints must comply with precise guidelines. This includes, for example, the condensation water test and the neutral salt spray test.

We use these methods not only to test our new developments in the area of wetting and dispersing agents, rheology and surface additives and adhesion promoters, but to help our customers. Based on our test results they can narrow down the list of relevant BYK additives before they actually put their own formulations to the test with the respective test methods.

A special test procedure that we use to simulate cathodic corrosion protection, (which is needed for pipelines), gives us information about the influence of our additives with regard to cathodic delamination (also known as cathodic disbondment, or CD). Here, adhesion promoters in the coatings can help impede the inevitable delamination process.

Alongside corrosion tests, we test how our additives influence mechanical properties, as protective coatings and ship paints are frequently subjected to high mechanical loads. The more flexible the coatings, the lower the danger of them becoming damaged by mechanical loads. We use the Erichsen test device to check the elasticity of a coating. If a more dynamic test procedure is needed, we use the direct or indirect ball-drop test.

Our additives improve the processability and performance of intumescent fire protection coatings. To discover which effects our additives bring about in emergencies, we subject steel that has been coated with test formulations to very high temperatures in a muffle kiln that simulates the appropriate fire load.

## Key Guidelines



We test our additives based on the following guidelines:

- Corrosivity categories in accordance with EN ISO 12944
- Condensation water test in accordance with EN ISO 6270-2
- Salt spray test in accordance with EN ISO 9227
- Mechanical loads using the Erichsen test device in accordance with EN ISO 1520
- Ball-drop test in accordance with EN ISO 6272





## The Cathodic Disbondment (CD) Test

is used to test the individual effects of our adhesion promoters on protective coatings.



Vacuum Dissolver



Spread Coating Line with Gelling Drums, Oven and Lamination Facility

## Replicating Spread Coatings Precisely

It can take significant time to transfer laboratory results to customer production lines. However, with our spread coating line, we can shorten the timeline considerably.

The formulations specified by customers can now be optimized in targeted test runs which are created under conditions that are as close as possible to production conditions. The materials can be applied both in a direct coating on the textile carrier as well as, with the aid of reverse coating, on release papers. Alongside the assessment of impregnation, foam behavior and surface properties, we are able to metrologically detect the viscosity of the material used during the coating.

The recorded values give us the certainty that customers can use optimized or newly developed formulations in their production without complications.

### Coating Thicknesses

Using our test procedures, we can test coatings from 0.1 mm to 5 mm.



Coating Head with Optional Viscosity Measurement



Laboratory Dryer with Coating Unit

**Tip:** With our low-emission additives and solvent-free dispersing agents, we support our customers in the development of environmentally friendly products.





Our spread coating laboratory facility can coat  
**10 meters of substrate** per minute,  
realistically replicating industrial conditions. The photo shows  
the coated and dried substrate.

With the help of our **cast film line**  
we check how our additives optimize monolayer films.  
To do this, we evaluate surface, dispersion, and mechanical  
properties.



# Compounding Completely Reproduced in the Lab

Design and innovation are two important aspects in thermoplastics processing. The ever-increasing demands made on the end products are accompanied by continuous advancements in production materials and processes. By creating optimized additives, we're able to significantly raise the physical limits of raw materials.

BYK has been applying our extensive know-how in the areas of couplers, modifiers and surface-active additives to the processing technology of thermoplastics for a long time. Furthermore, BYK has a long-standing experience in special process technologies like skin-core extrusion or specialized compacting processes, which enables us to develop and manufacture new, differentiating additive solutions with a wide range of functions such as flame retardancy, thermal stabilization, UV stabilization, nucleation, and anti-fog, for a wide spectrum of applications and for a broad range of plastic materials, including polyolefins and engineering plastics.

The knowledge and expertise of our specialists are enhanced by the exclusivity of our service lab equipment which includes a professional injection molding machine just like the ones used by the end producers, as well as special lab equipment



Cast Film Line



Intermediate and Finished Products

for the manufacturing and processing of granular plastics, such as single and twin-screw extruders and a two-roll mill.

At BYK, each and every step in the compounding process can be reproduced in the lab – right down to the finished product. Standardized test methods, such as filter pressure tests and other structure and surface analyses in our material testing department allow us to fully evaluate and characterize the effects our products provide. In the thermoplastics service lab, customers don't just get part of the solution, but have the advantage of developing their products over the entire production process.



Injection Molding Machine



## Regulatory information:

Many products in our portfolio for liquid color masterbatches and solid masterbatches comply with the FDA and EU regulations for food contact.

**Tip:** Our process additives help to reduce VOC emissions.

# Stress Test for Molding Compounds

Additives optimize material properties of compounds. In our lab, we demonstrate how they do it.

In our SMC line, components defined by the customer (such as resins, fillers and reinforcement fibers for the production of molding compounds) are optimized using our additives in targeted test runs. After this, the mixture is shaped in our 1,000-ton press, then sent to material testing and tested in terms of surface properties, better coating adhesion, color homogeneity and emission behavior.

**Tip:** For fire protection formulations we recommend the following wetting and dispersing additives: BYK-W 995 and BYK-W 9012 as well as the low-emission BYK-W 9010 and BYK-W 9011.

**Tip:** Thanks to their release properties, our process additives make the production of plastics easier.

Testing on high-quality laboratory equipment that measures the color and gloss, simulates stone chipping and tests short- and long-wave features result in a customer-optimized additive formulation and improved SMCs. Only those compositions that pass the test will become the specific compound formulation we recommend to customers for use in mass production.



Compress Eco with a Maximum of 1,000 Tons of Press Force



SMC Line with Glass and Carbon Fiber Cutting System



Our **SMC Pilot Plant** is used to optimize customer formulations as well as to test new additives for sheet molding compounds.



Custom made for BYK: We use this

## Fiber Spray Gun

to test how our additives behave  
in our customers' materials.



# The Optimum Additive for Every Shape

BYK additives for glass fiber reinforced compounds enable optimum end products in terms of stability, surface quality and processing. In our laboratories, we simulate the loads that the materials will be subject to, whether as boat hulls, swimming pools, trailer walls or any number of possible applications.

As far as surfaces are concerned, virtually any product can become problematic. This particularly applies to thermosets such as boat hulls, swimming pools or bathtubs made of glass fiber reinforced plastics (FRP). Our additives for this group of plastics ensure our customers – and, ultimately the end consumers – an optimum product in terms of stability or surface quality and processing. To ensure that we reach this essential goal, we simulate the typical production processes of our customers in our service labs almost every day.

Light and stable fiberglass reinforced plastics can take on virtually any shape. Because of this advantage, they are used for a wide variety of technical applications. We can replicate all of our customer's problems in the laboratory with our fiber spray gun. In reproducible test runs, we establish the optimized additive selection and dosage in each case. This means perfect application properties, even and stable colors and flow properties, less trapped air and optimized styrene emissions.

The formulations developed in this manner can then be replicated by the customer in their own plants under production conditions and through technical service requests, training and seminars, we happily and regularly pass on our practical knowledge to our customers.

**Tip:** Our processing additives BYK-P 9065 and BYK-P 9080 increase the process safety and simultaneously ensure more efficient processing.



Vacuum Infusion



Producing a Test Specimen



## Regulatory information:

Our products contain a broad selection of surface additives as well as defoamers and air release agents that comply with the food contact legal status of the FDA and EU.



Streaming Form

## Strong Tests for Lightweight Components

Fiber-reinforced plastics must be able to withstand considerable mechanical loads, especially when they are used in the structural components of vehicles. That is why we subject them to various tests, like the dynamic testing machine, for example.

In doing so, we repeatedly compress and stress the component in all directions and in several successive cycles. This way, we can prove that our coupling agents are doing their job in our customer's formulations. They generate solid and dependable connections between fibers and resins, which are exceptionally durable. We provide our customers with the data gained in these tests.

It is not only our adhesion promoters that play a key role in the production of advanced composites, but also our wetting additives. They improve the quality of the finished components. As a component of resins, they ensure that the liquid absorbs the fibers quickly and completely – without any air inclusions or other defects. We demonstrate this through the streaming form test.

We prove that our process additives accelerate the production process with the aid of various tests which show how easily components refined with our additives can be released from their molds.



Carbon Fiber Plate

### Did you know that ...

... thanks to their high strength, our coupling agents in the 8000 series can save on materials?



### Our Additive Recommendation:

Viscosity Control Technology (VCT) from BYK is based on a combination of processing additives (Thixbreaker and Thixbooster), to control the initial viscosities in the system.



With the

## **Dynamic Testing Machine**

we reproduce the varied mechanical loads to which lightweight materials are subjected. The critical question here: Do our coupling agents improve customers' formulations?



## The **Tensile Test**

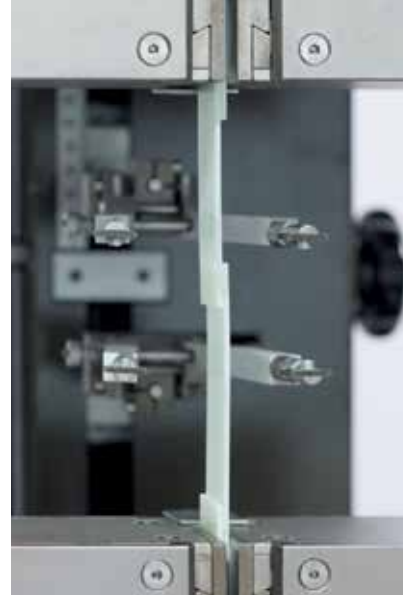
The **Tensile Test** is the simplest method for testing the effect of an adhesive. A maximum of ten specimens in the material testing machine suffice to produce valid results.



The Speed Mixer Creates Adhesive Specimens



The Rheometer Tests the Flow Behavior



The Materials Testing Machine Tests Adhered Material Samples

## Tailor-made Properties

The effectiveness of adhesives depends on several factors. They must perfectly wet the substrate and be easy to process. Their flow behavior – especially on vertical surfaces – is critical.

Our additives help adhesive manufacturers to adjust these different parameters precisely and, if required, according to a customer's individual requirements. Our special measuring and testing equipment accurately demonstrates the desired adhesive properties.

We test to what extent our surface additives have influenced the mechanical properties of an adhesive, and we do so by using tests such as the tensile test. The more force used to destroy the specimen, the stronger the adhesive force, and the more effective the additive.

We use our materials testing machine to simulate, among other parameters, two different tearing processes. In the tensile shear tests, two material specimens which are adhered to one another are torn apart in the vertical plane. Peel tests determine how easy or difficult it is to peel a material at right angles from another.

### Tip:

BYK-1640 and BYK-093 are ideal defoamers for aqueous adhesives, such as floor adhesives or PSA (pressure sensitive adhesives).

At the same time, we test to see which effects other additives, which we have recommended to our customers, have on adhesion. So, for example, we can demonstrate that silicone defoamer makes it considerably easier to produce the adhesives, and simultaneously has no negative effects on adhesion.

We use the rheometer to test flow behavior. It takes just a few milliliters of adhesive to discover how it will behave on a vertical surface at high speed and with a precisely defined layer thickness. As uncomplicated as this test may be, evaluating the results is much more demanding, because it requires expertise and metrological proficiency to interpret the results correctly.

In the end, our customers receive a very precise picture of how an optimized product behaves in the different phases of the adhesive process. With this, the rheometer results provide an outstanding foundation for subsequent tests under real conditions.



### Regulatory Information:

For food contact, we offer a broad range of additives, which fulfill the requirements of guidelines such as the FDA guideline 175.105.

# Perfectly Lubricated

Additives make an efficient oil lubricant for the industry.

Our defoamers play a key role, as they do not form bubbles when the lubricant is put in motion. This ensures that the metals are thoroughly and evenly lubricated. Our wetting and dispersing additives also ensure that solid components, such as graphite in forge lubricants, distribute easily, and our rheology agents prevent these particles from settling.

**Tip:**

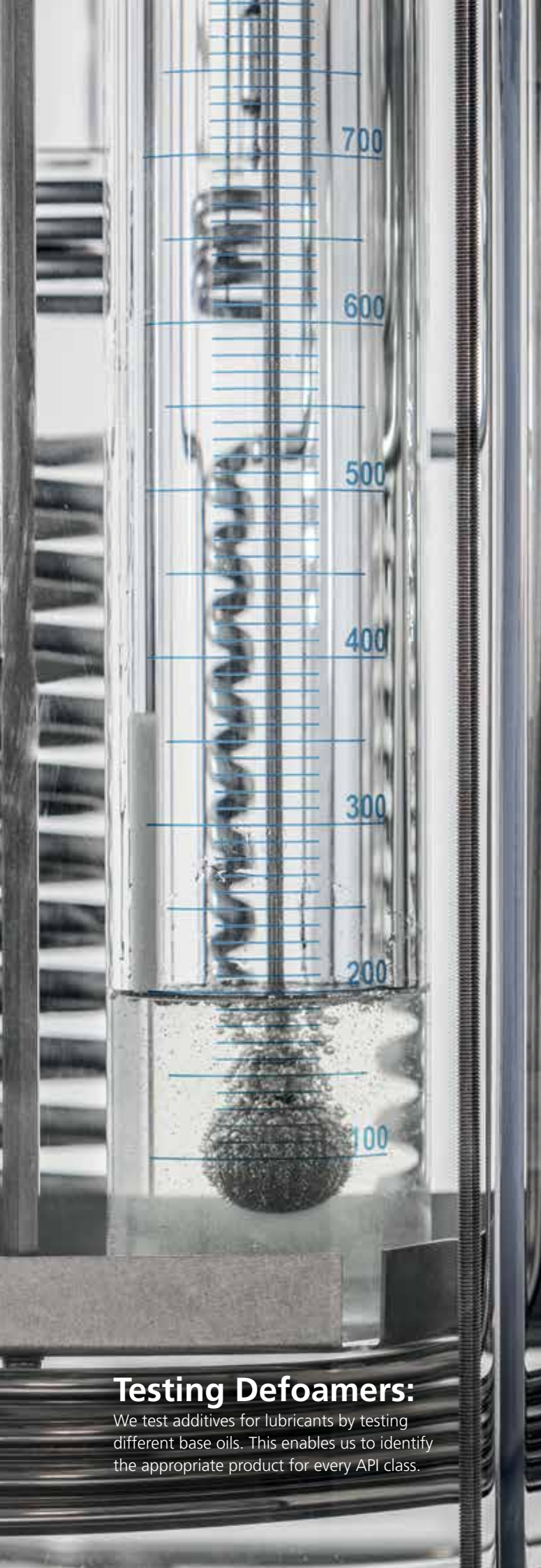
For each base oil there is the ideal organoclay as a thickener for the grease.



Walker







## Testing Defoamers:

We test additives for lubricants by testing different base oils. This enables us to identify the appropriate product for every API class.



Penetrometer



Colloid Mill

The selection of the appropriate additive is critical for the success of the application. With the aid of the foam tester, we can discover which qualities the defoamer must have to ensure it has the ideal effect in the oil.

Greases, however, require a high resistance to be able to withstand the mechanical loads and high temperatures to which they are subjected. Based on the type of base oil used in the grease, we identify the most suitable thickener, and produce a grease specimen in a colloid mill. We process this using a walker, in order to simulate the mechanical load. Finally, we use a penetrometer to measure the consistency of the grease using precisely defined conditions. This is how we establish whether the grease that has been optimized using our additive has reached the NLGI class, and can withstand the requirements of the application.

### Tip:

There is a suitable defoamer for every API class of base oils

If we want to know how our additives optimize the transparency, quality and leveling properties of flexo inks, we create a sample print on our

## Flexographic Laboratory Machine.

We then use grid points to test the result.





# Welcome to Our Mini Printing Works



Defoamer Test



IGT Printing Test Device



COF Tester

Printing and packaging products are mass-produced and expected to hold up to handling and storage conditions without damage to their appearance. Our wax additives refine overprint varnishes and our surface additives impart good slip to ensure the printed surfaces withstand abrasion and mechanical stress.

In addition, BYK can provide additives for the layers of color beneath. This is where wetting and dispersing agents come into play; they enable pigments to be finely distributed, in solvent- and water-based or even in UV-curable colors. Rheology additives enable the optimum flow behavior for each printing procedure, and defoamers ensure an absence of bubbles both in the production and the processing of the colors.

In our laboratory for printing inks, our tests enable us to replicate virtually every requirement that the various printing procedures (flexographic, offset, gravure, and screen printing) can produce. We use the results to identify the additive mixture that will suit the ink; in doing so we also take into consideration the regulatory requirements.

We use the high-performance shaker in parallel to quickly grind up to 20 pigment specimens with different wetting and dispersing agents and then use the data to determine the perfect additive for the respective pigment dispersion. To visually inspect the quality of the ink as well as its transparency, we use the appropriate application device for each printing procedure. These include the flexiproof laboratory printing machine for flexo inks as well as the IGT color application device for offset inks.

In terms of the quality of the overprint, we offer two test procedures. We prove scratch resistance with the aid of the rub tester. It rubs the surface that has been provided with our wax additives up to 1000 times in order to establish the resulting abrasion. The slip, which is required in many types of packaging, can be proven using the friction peel test.



## Regulatory Information:

Our VOC-free products fulfill the regulatory standards. We also offer a varied selection of additives for inks for food packaging.



## Our Additives have been Optimized for these Procedures:

- Offset
- Gravure
- Screen printing
- Flexographic



# Stable – Even Under Pressure

Industrial inkjet printing supports the most varied of applications, from labels, textiles, and tiles to large-scale banners and 3D printing. Due to the spectrum of procedures and devices, there is also a wide variety of inks.

All inkjet inks have the same two key requirements. First, they require pigment dispersions that work with the tiny nozzles in the printing heads when the inks are applied to the substrate under high pressure. It's also necessary to be able to store the inks for a longer time. This applies to solvent-based, water-based, and UV-curable systems.

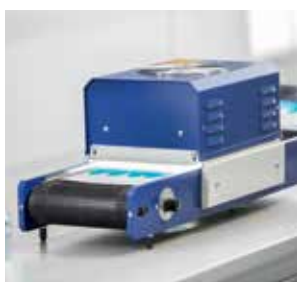
Our wetting and dispersing additives support these properties. They ensure a finely distributed, long-term stable pigment dispersion. Our surface additives improve the printability ("jettability") of the systems. Our wax additives and defoamers also contribute considerably to optimizing the inks. We use a series of tests to establish how the suitable additive combination must behave – there are no standard solutions.

We use the particle size analyzer to measure the size and size distribution of the pigment particles. Then, we use the results to assess the quality of the pigment dispersions and select the most suitable dispersing additive.

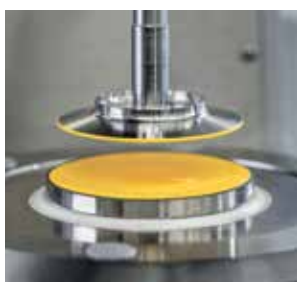
The rheology of the pigment dispersion is an additional parameter, as it influences the flow behavior of the finished inks. The flow should be as Newtonian as possible. We establish this using the rheometer. On the other hand we can follow the path the ink takes and the drops contained in with our lab printer. This enables us to make precise statements about the printability of the inks when they are influenced by our additives.

## Tip:

The high molecular weight wetting and dispersing additive BYKJET-9131 has been specially designed for magenta, cyan and yellow pigments; use BYKJET-9133 for carbon black pigments.



UV-curable



Anton-Paar Rheometer

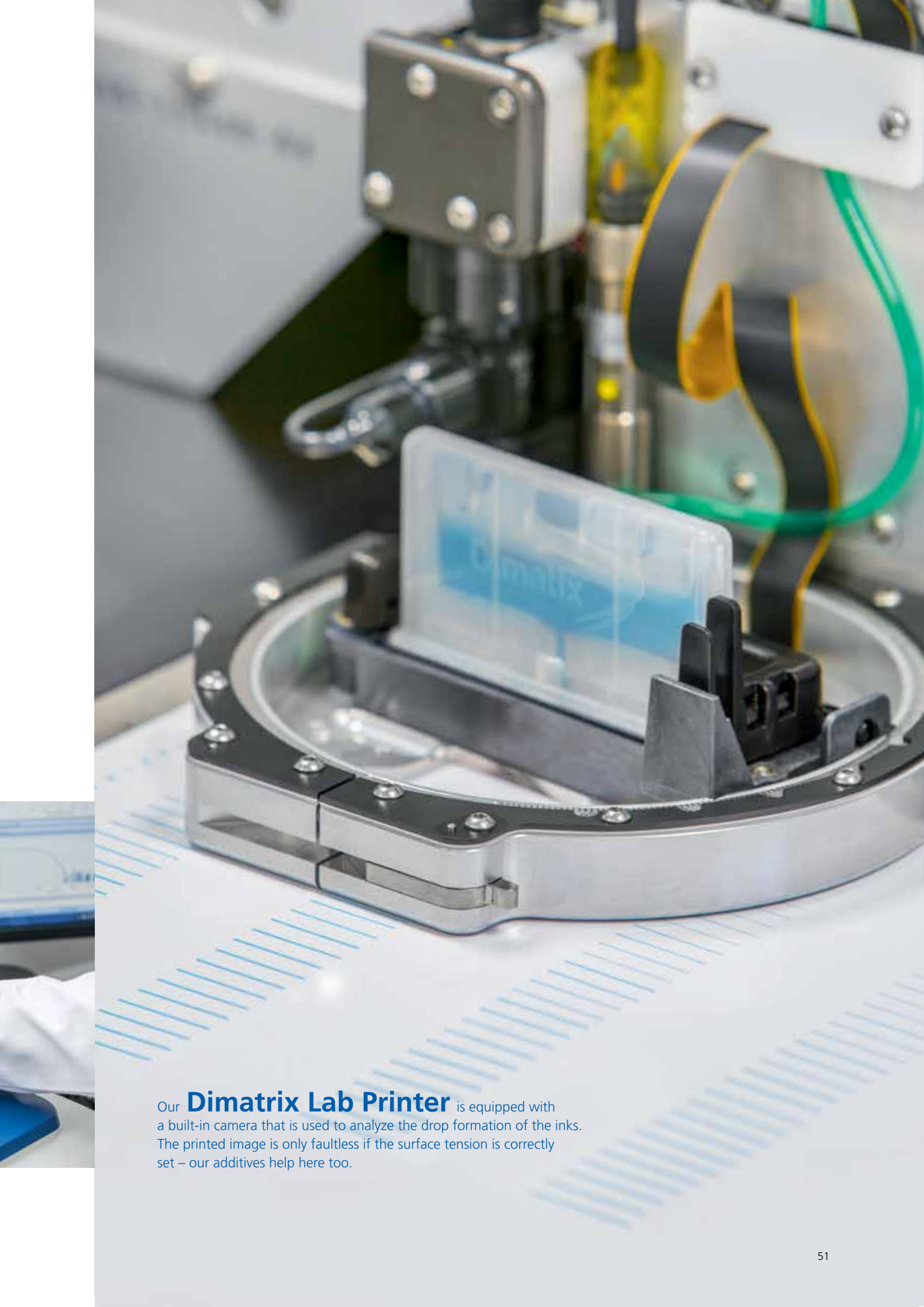


## Our Additives Support these Procedures:

- Drop-on-demand (DoD)
- Continuous Inkjet (CIJ)



Particle Size Measuring Instrument



Our **Dimatrix Lab Printer** is equipped with a built-in camera that is used to analyze the drop formation of the inks. The printed image is only faultless if the surface tension is correctly set – our additives help here too.

To validate the behaviour  
of our defoamers in coating  
colors, we use the  
**foam tester.**





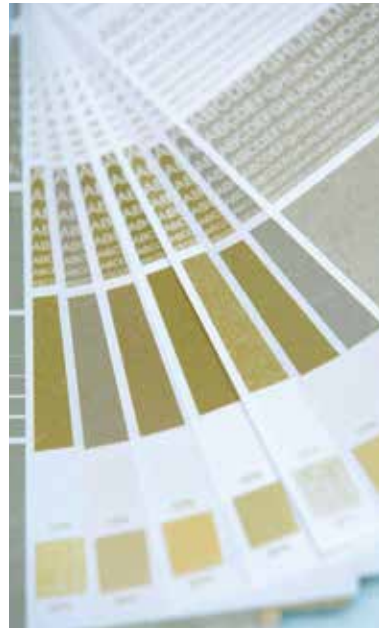
# Added Value Thanks to Special Surface

Paper is often considered to be a commodity product. However, the addition of a coating to the paper surface can increase the value of the product by improving its performance.

Equally, the application of a coating may allow the development of new functional properties that permit the paper to be used in a new higher value application field. The coating may, for example, improve and optimise the printing quality on the paper, deliver barrier qualities to the paper or facilitate the use in special printing applications, such as inkjet, thermal and carbonless copying applications. In all cases, additives and functional reagents are essential to developing optimised solutions.

Our wide range of additives and functional reagents assist in the production of an optimised coating color, improve the coating process, enhance the performance of base papers, and deliver special functionality. Products include wetting and dispersing agents, defoamers, rheology modifiers, surface active agents, wax and polymeric products, and specialised clay materials.

We employ extensive analysis techniques in order to assess the properties of a paper surface and understand its impact on the paper's performance in different applications. Based



One ink – different paper qualities



Krüss Paper Surface Energy Analysis

on these analyses, we develop improved surfaces with improved performance. Equally in key applications, we assess the actual performance of the papers to demonstrate what type of improvements can be obtained.



Calender



## Our FULACOLOR products:

Our additives based on acid leached phyllosilicates produce reactive and absorbent paper coatings, e.g. for inkjet printing applications.



Surface Wetting of Leaves



Coated Seeds

## Developed so that Seeds Trickle – Grain by Grain

Seeds trickle through large sowers and into the earth – and the grains must not stick to one another.

Grains can be prevented from sticking together if the coatings, which the producers apply to protect the plant, have been optimized. That's where our additives come in.

Our wetting additives support the coating process by reducing the surface tension of the particles. Our rheology additives optimize the flow behavior of the seed dressing and our wax additives prevent dust development, because they generate smooth, hard surfaces.

To test the effect of our additives in the formulations of our customers, we replicate the seed coating process. To do this, we use the Satec coater. We then test the coated grains with the shaker test: we measure the angle produced when we cause a small pyramid of grains to trickle.

The smaller the angle, the better the seeds will trickle. We use the **shaker test**, to establish this.



Shaker Test



### These Additives Prevent Dust Development:

AQUACER 581,  
AQUACER 582,  
AQUACER 583

In the **Satec Coater** we replicate the process through which the grains of the seed are coated. We use the results to then identify the most suitable wetting and rheology additives for the respective seed coating.







## pH Meter

Our additives are suitable for use in acidic cleaning agents or for basic products. A pH meter allows us to establish which product can be used in a the customer formulation.

# Improving the Flow Behavior and Gloss

Shiny surfaces appear well cared for – that's why floor polishes must not lose their shine, even under considerable stresses.

Our defoamers, surface and wax additives optimize care products that are developed for industrial applications and ensure that the result is maintained. We test this in our crock-meter, which simulates the load that a floor must withstand, and then measures the abrasion. This is how we establish in detail which additive will suit a particular formulation and how long the floor will remain protected with this polish.

Cleaning agents must fulfill a variety of requirements. A suitable additive must withstand the pH value of the cleaning agent. We use our pH meter to determine this precisely.

Cleaning agents must not immediately run off vertical surfaces, a challenge that we overcome using our rheology additives, which are based on phyllosilicates. To test the formulation and the additive, it's actually quite simple: we spray the mixture on a vertical Plexiglass pane to show the flow behavior.



Our additives can be precisely coordinated to the **pH value of the detergent and cleaning agent.**



Crockmeter



## Raw Materials:

Our OPTIGEL additives are based on activated phyllosilicates which regulate the thixotropic flow behavior. Our sustainable wax additive based on sunflower wax significantly improves the hydro- and oleo-phobing.



## Regulatory Information:

BYK defoamers, surface, and wax additives comply with EU guidelines.



## Our Additive Recommendation for Anti-slip and Anti-tack Effects:

AQUACER 528, AQUACER 595, AQUACER 1031

# Our Plus for Battery Performance

They should be long-lasting and stable – these are the two authoritative requirements placed on lithium-ion storage batteries by end customers. Our additives enable a decisive improvement in both attributes.

At our special laboratory in Amagasaki, we develop customized products for battery manufacturers and their suppliers. The electrodes are the focal point of our efforts. Their performance can be improved by up to 30 percent by optimizing the coating slurry with the help of additives.

Even very small quantities of our products can enhance the conductivity of the electrodes – and thus the overall performance of the batteries. In this way for example, our wetting and dispersing products prevent an agglomeration of the carbon or graphene particles that act as conducting materials in the electrode slurry. The additives create an even grid structure with an optimum interval between the particles.

This reduces the viscosity and leads to an increase in particle content. The surface-active attributes of our polymers further enhance the conductivity. Our sheet-silicate-based rheology additives also improve the substrate adhesion.

Our products also enable optimization of the ceramic coating of the separators that separate the anode and cathode. In this respect and in addition to the wetting and dispersing additives, surface additives as well as defoamers contribute not only to greater reliability of the coating, but also have a positive effect on the overall coating process. The result is a uniform coated ceramic separator without any surface defects.

To enable exact validation of the effect of our formulations in the applications of our customers, we use test procedures that are commonplace in the electronics industry. Examples of these are charging and discharging, drainage and stability tests, as well as voltage or resistance measurements. We use the glovebox for the manufacture of the battery cells in which we test the additives. Our test methods also enable us to ensure that our customized formulations comply with the respective regulatory requirements.

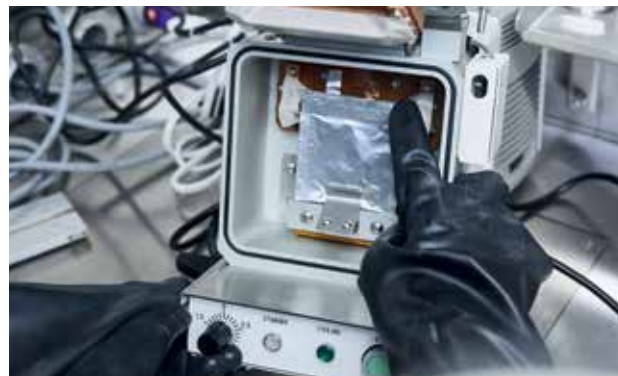
**Our tip:** In combination with our polymer thickeners LAPONITE RD ensures high stability of the aqueous coating slurries.



Working in the Glove Box



Sample Preparation

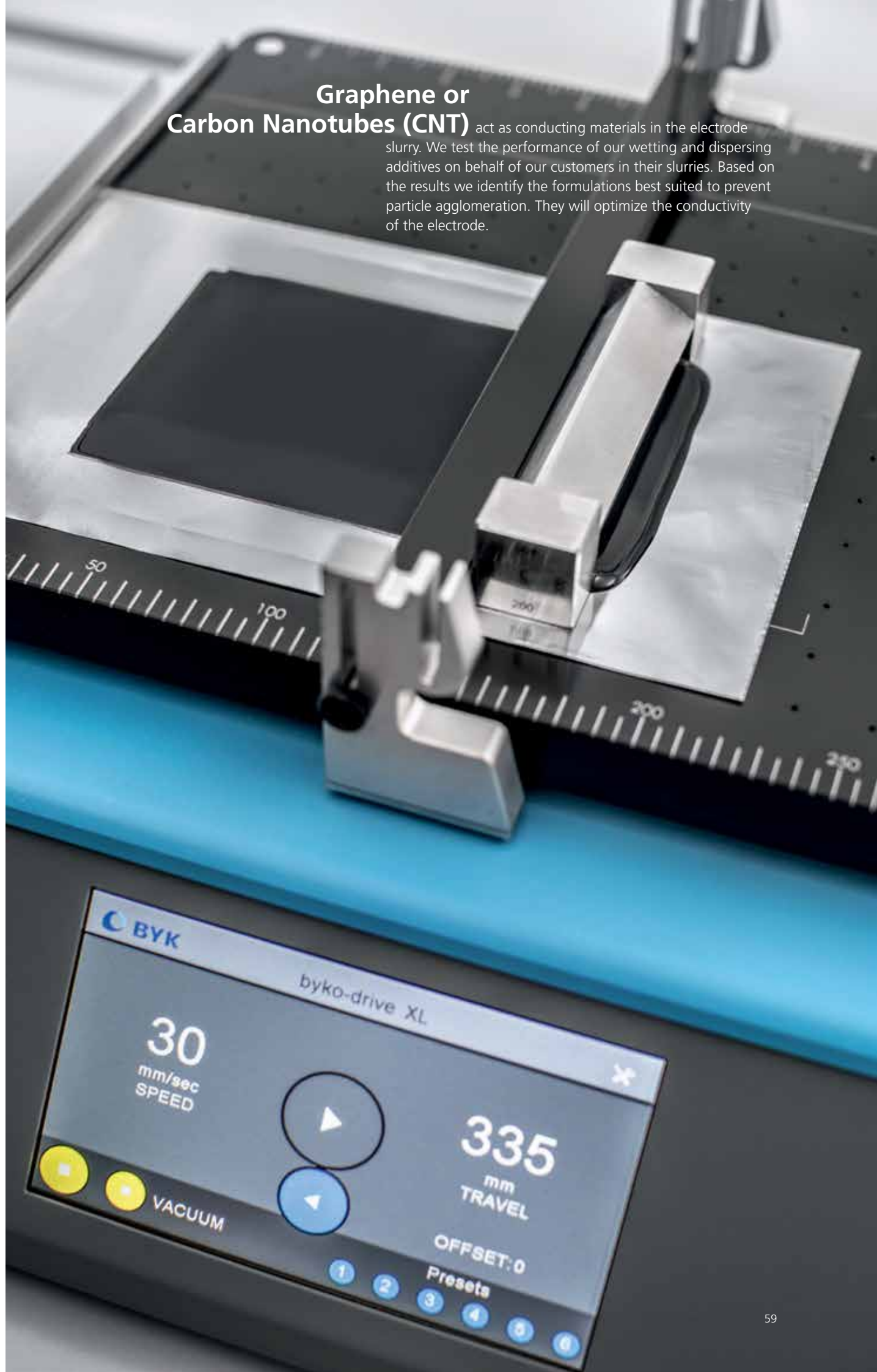


Test Run



## Graphene or Carbon Nanotubes (CNT)

act as conducting materials in the electrode slurry. We test the performance of our wetting and dispersing additives on behalf of our customers in their slurries. Based on the results we identify the formulations best suited to prevent particle agglomeration. They will optimize the conductivity of the electrode.





**260°.**

The maximum temperature in the roller kiln is 260°. We use this to subject the formulations for drilling fluids to artificial aging. It is only when our rheology additives withstand this stress test that they are suitable for use in the drill hole.

# Equipped for Heat and Pressure

The deeper the drilling, the higher the temperatures in the drill hole – and consequently the higher the demands on our additives for drilling fluids. They must have particularly high thermal stability – only then can they fulfill their rheological function at every stage of the drilling process.

Our test procedures help our customers to identify the additives that perfectly suit the temperatures in the drill hole as well as the liquids used.

We use two methods to establish thermal stability: artificial aging of the material with the help of the roller kiln, and the filter press. The first test gives us information about how the

drilling fluid behaves in the depths of the drill hole, where temperatures can reach up to 260°C. This method enables us to test the behavior of the chosen additive in the liquid at different temperatures.

The filter press is used to test the filtration rate and quality of the filter cake that forms during the course of the drilling process. The various conditions in the drill hole, such as high pressure and high temperatures – can also be imitated in the filter press. This test gives us information about the behavior of the additives under realistic conditions.

Once we've identified the formulation, we then adjust the viscosity, yield point, and gel strength at the respective specified temperature. For this purpose, we test the drilling fluid that has been provided with the additive in a rotating viscometer. This procedure can also be used to measure the dynamic setting behavior of solids.



Pressure Cell

## Tip:

Our CLAYTONE products can be used to create targeted rheological properties for different temperatures. The result is highly efficient drilling fluids.



## Our Additive Recommendation:

The BYK-150 thinner is suitable for water-based drilling fluids and the BYK-GO 8700 family is best for oil-based drilling fluids.



# Better Flow Properties

If it flows, it is efficient – that's how the oil production industry sees it. Specialists speak of flow assurance – and without our additives they would not be able to achieve this.

When added to the crude oil, our polymer-based additives ensure that when the oil is on its way out of the hot interior of the earth it cools very slowly on the surface, and does not become tough and clumpy. Our additives also prevent paraffins from being deposited from the crude oil and onto the conveyor pipes and our wetting and dispersing additives offer corrosion protection to the pipes. The art of flow

assurance exists in creating a combination and concentration of additives that suits the chemical composition of the oil.

For this purpose, we use special tests to replicate various situations in the oil production, such as the pour point. This test shows at which temperature the cooling crude oil is still

## The Pour Point Test

We use this to determine which additives keep the raw oil flowing even at low temperatures.





Rotating Electrode



Cold Finger Test



fluid. Our additives keep the oil flowing when ambient temperatures are considerably colder.

The “cold finger” test gives information about how the composition of our polymers must be created in order to prevent paraffin deposits.

The corrosion behavior, however, is measured using the rotating cylinder electrode. It analyzes the behavior of our additives in an oil-water mix: Are we able to orientate the polymer chains on the metal surface so that the corrosion process can be prevented? Do the additives protect the metals from corrosion under turbulent streaming conditions? Then they are suitable for this task.



### Information About the Additives

Our newly developed additive range includes pour point depressants and wax inhibitors for various types of crude oil.

## We Call that Sustainable

Sustainability begins in the laboratory. Starting in the development phase of new products, we ensure that the planned formulations meet the regulatory requirements of the application and our own provisions on climate protection as well as CO<sub>2</sub> or VOC reduction respectively. Our suppliers are required to observe our code of conduct based on the Global Compact principles of the United Nations. Once the laboratory phase is concluded, we enter newly developed products in national and international chemicals registers, and document this in our BRIEF document.



### BYK Global Regulatory Service

## Learn about BRIEF

Each product is only as good as the service that accompanies it. That's why we support our customers beyond matters of application technology. With our Global Regulatory Service, we also make it easier for customers to select their raw materials and ensure that they can use the same BYK additive in their products worldwide.

Regardless of their production location, our customers can rest assured that our additives comply with the guidelines of their region with regard to product safety, health concerns and environmental protection. This also applies to the provisions of special markets, for example, in the areas with food contact, or in the market for oil and gas production.

All this information is provided in a BRIEF document (BYK Regulatory Information Extensive Form) for each additive. Details about the processing as well as the safe handling of our products can be found in the technical data sheets as well as in the safety data sheets.

Our regulatory service specialists are directly available on the internet [byk.com/regulatory-contact](https://byk.com/regulatory-contact). They will provide regulatory information to buyers and developers who are testing new formulations. They also support specific projects with their expertise on product safety, product stewardship and materials registering.



# Compact Practical Information about Additives

Which formulation is correct? How can it be incorporated, and which method or equipment can be used to test the results? Customer seminars, which BYK offers regularly to customers of different regions and for different target groups, provide answers to these practical questions concerning our additives.

At these multi-day events – usually held at our location in Wesel – the participants acquire fundamental know-how. Through practical demonstrations, our technical experts show how the additives work and how they can be used to optimize processes and product properties. Equipment from BYK Instruments is often used for success monitoring. Information on how to operate them is also provided at the seminars.

Seminar participants have the chance to connect with BYK specialists about the application and sector-oriented end uses with which the participant will also become familiar during the seminar. Laboratory visits and a production tour provide even more opportunities to learn about the application of additives.

Regardless of the product groups covered in the seminar, our experts also take into consideration the sector-specific requirements of the participants. In special national seminars, they also discuss regional details and regulations. As needed, we offer special “meet the expert” tours with employees from research and development, the laboratories, marketing or sales.



## Practical Training in Consultation with the Experts

The participants of our customer seminars should be similar in terms of their prior knowledge and industry mix. In order to convey training content in a group setting, we compile a targeted guest list and send out personal invitations for each seminar. Our experienced seminar team plans a program that is tailored to the participant group, with sufficient time for individual specialist discussions. It's no wonder that even long-standing customers have come to consider our seminars to be practical further training for their employees.



# Same Standards Worldwide

Whether in Germany or China, the U.S., Russia or Korea: our laboratories offer the same service worldwide. The equipment is state of the art – so we will always find the ideal solution for your application. To find your closest laboratory, follow this link:  
<http://www.byk.com/en/contact/locations-overview.html>.







**BYK-Chemie GmbH**

Abelstrasse 45  
46483 Wesel  
Germany

Tel. +49 281 670-0  
Fax +49 281 65735

[info@byk.com](mailto:info@byk.com)

For technical service enquiries, email  
[Technical.Service.BYK.Wesel@altana.com](mailto:Technical.Service.BYK.Wesel@altana.com)

[www.byk.com](http://www.byk.com)