



BECHEM

BECHEM, headquartered in Hagen (NRW), is one of the leading manufacturers of high-quality specialty lubricants. These include cooling and forming lubricants that optimize manufacturing processes in metalworking. Another product line are lifetime lubricants. They are used in mechanical and mechatronic components to ensure smooth operation throughout their entire service life.

BECHEM convinces not only with solutions, but also with figures: Founded in 1834, the technology leader has been in the market successfully for 189 years. It has more than 700 employees worldwide, offers 1,200 lubricant solutions and has 72 international sales partners.

Leatherette: Precise testing of clear coat on plastic film

Noise caused by oscillation or vibration while driving a car is an absolute no-go in all vehicle classes. A good reason for car makers to invest in the development of advanced noise prevention methods.

As one of the leading companies in lubricant technology BECHEM offers more and more air-drying anti-friction and anti-creak coatings for the automotive industry. These are intended to reduce, ideally even eliminate, unwanted noise in the vehicle.

Chemist Silke Elles and Florian Paland, in charge of solid film lubricant development at BECHEM, explain why coating thickness testing becomes ever more important in the application of anti-creak coatings.

Sucess story BECHEM

The black PVC sample foil tested by Silke Elles is the base material for a door trim. It is heavily grained and trial coated with anti-creak paint in the center. The nominal coating thickness measured by the PaintChecker Mobile is around 15 µm. By the way, just 5 - 10 grams of anti-creak paint is applied on each door panel.



Noise in a car: More than just a luxury problem

Noise reduction in the vehicle is not just a matter of better understanding the radio or communicating with the passengers. The unwanted noise can also have negative impact on driving safety. Disturbing background noise impairs the driver's attention and can thus lead to carelessness.

Along with the safety aspect, driving comfort is also becoming ever more important: Silent electric drives and low-noise combustion engines make noise – e.g., from plastic parts rubbing against each other in the cockpit – more and more noticeable and annoying to the ear. Unwanted interior sounds, such as a creaking door panel or squeaky leather seats, impair the customer's comfort experience.

Silent motion is therefore a top priority in the development of all interior components. Almost all car manufacturers and automotive suppliers now use anti-friction coatings and special noise reduction lubricants. And this is exactly where lubricant expert BECHEM steps in.

The special lubricants supplier

By selective vibration damping and optimization of the friction coefficient, lubricants enable noiseless movements of any interior components such as cup holders, armrests, door panels, storage compart-

ments, actuators and switches. The noise reduction lubricants are also used in electrical contacts, chassis and braking systems, seats as well as belt assemblies, locking components and hinges.

“The PaintChecker is small, handy and totally mobile. That is an unbeatable advantage”

Silke Elles

Chemist for anti-friction coatings BECHEM

A booming sector are anti-friction coatings; they reduce noise in e.g. plastics or leather and vinyl materials. Partly BECHEM uses the innovative microcapsule technology for these anti-friction coatings. Microscopically small containers filled with lubricant are embedded in a coating layer and release their lubricant charge to the friction or lubrication point under load. This creates a high-performance lubricating film between the friction partners and prevents disturbing noises – provided that the coating thickness is within the given tolerance range.

Proper coating thickness matters

When asked why coating thickness measurement is getting ever more important

for BECHEM, Florian Paland replies: "Nowadays, more and more materials are installed that undergo relative movement as a result of driving. Large hollow bodies like a vehicle door then cause audible tones and sounds. This is basically comparable to a guitar. It's the hollow body of the musical instrument that produces the melody."

However, it is not melodious sound that is created in the car, but noise. These can be significantly reduced by coating with special anti-creak paints. However, the transparent, water-based coatings require different thicknesses for different applications. And this needs a means to measure it accurately. In BECHEM applications the coating thickness has great impact on the functionality, because if the anti-creak coating is applied too thick or too thin, a disturbing noise level remains.

In the past, large variations in coating thickness – in some cases more than 80 µm – had to be accepted, resulting in a loss of acoustic quality. This was because previously the lab staff could only check the coating thickness indirectly.

"The classic, contact-based methods operate with a certain pressure. They were not suitable for measurement because they permanently gave false readings. Significantly less coating thickness was displayed than was actually applied", the chemist explains.



Whether in electric actuators, such as those installed in window lifters, seat or mirror adjustment systems, or in seat covers: Low noise is a key issue in the automotive industry. Especially in times of ever quieter (electric) cars, silence in the passenger compartment has become a must-have, not only in luxury limousines.

"In order to measure the coating thickness at least approximately in a qualified manner, a metal sheet was coated along with each application of the anti-creak paint. A skilled laboratory technician coated both parts evenly with a spray gun. The coating thickness of the painted metal sheet could then be measured. That was a complex, errorprone and time consuming test method," recalls Silke Elles.

Easier said than done? Finding the right measurement system

Therefore, the chemist team went to a trade show to review the latest solutions in coating thickness measurement.

BECHEM was looking for a system that could test transparent coatings on plastic substrates. Initially, the lab crew looked at a Swiss brand of coating thickness gauge. "But the device was so bulky and clumsy that it was not at all suitable for our purposes – i.e., testing in the lab or visiting customers," Paland recalls.

The contact with OptiSense came about rather by chance: "At that same trade show, we also took a look at the booth of the Haltern-based manufacturer. The Paint-Checker Mobile was exactly the right measuring device," Paland sums up

the trade show visit at that time, "it is small, handy and can be quickly carried from A to B in its case. Besides its user-friendly handling, the PaintChecker primarily had to prove its measuring capability. For this purpose, the coating thickness determined optically by cross-section was used as the reference for the application of the OptiSense system.

The challenge: measuring transparent anti-creak coatings on grained leatherette

"Our coatings are quite thin, usually around 15 µm. Furthermore, the substrates have very inhomogeneous surfaces and are quite soft. Measuring the transparent, thin anti-creak coatings on coarse-pored, grained leatherette, PVC foil or TPO foam is a very special challenge – really tricky," explains chemist Elles.

The OptiSense demonstration in BECHEM's laboratory was a complete success: "The PaintChecker is the only physical-based measuring system that can measure the actual thickness of the transparent anti-creak coating on a rough plastic surface. The device was therefore immediately added to our investment plan," says Paland.

Faster development cycles thanks to lab simulation

Meanwhile the PaintChecker Mobile has been in use in BECHEM's laboratories for a long time. In this lab customer requirements regarding noise reduction are analyzed and suitable lubricant solutions are developed. Testing the lubricants on model systems, original components and materials as well as simulating the different, vehicle-typical operating conditions considerably shortens the development time.

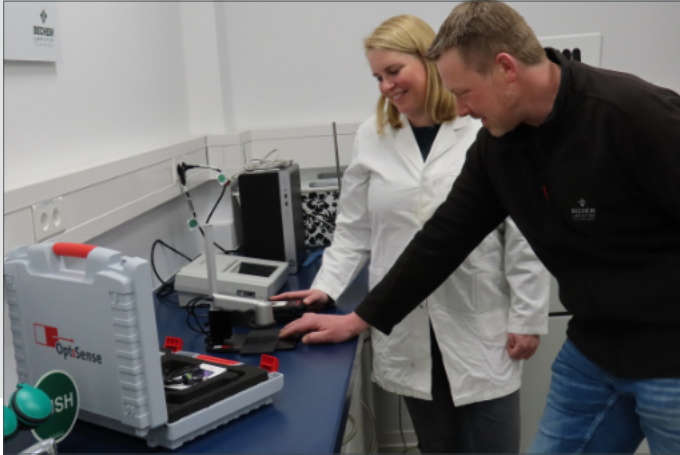
The Chemists are investigating a wide variety of options to find out what composition an anti-creak coating must have so that the friction partners, i.e. the two materials in contact, can coexist silently during driving. Afterwards, the appropriate thickness for this particular coating application is determined.

One phenomenon to be examined is stick-slipping. It occurs in a wide variety of areas: wipers stutter across the windshield. Chalk squeaks when writing on the blackboard. Door hinges creak.

Materials such as rubber, plastics or synthetic leather creak when the surfaces in contact alternately adhere to each other

Sucess story BECHEM

In a vehicle, noise reduction is part of the requirement profile. The search is on for a coating that minimizes and, in the best case, eliminates noise. The coating solutions for vibration-induced noise are analyzed and documented by Silke Elles and Florian Paland using the PaintChecker Mobile.



for a short time and then come loose again. This depends on the structure of the respective surfaces.

Even areas with microscopic roughness can interlock under pressure in such a way that perceptible creaking or squeaking sounds are emitted. The creaking behavior of this so-called stick-slipping is also affected by factors such as contact pressure, temperature, contamination, humidity and material fatigue.

Accurate measurement data for stick-slip analysis

A typical measurement procedure is the stick-slip test, also known as adhesive slip analysis: while applying standardized contact pressure, a material sample is rubbed to another material sample, mounted on a moving slide. Sensors then measure the extent of static friction based on the movement of the slide.

The stick-slip behavior is subsequently correlated to the applied coating thickness measured with the PaintChecker. As a result, the team of four chemists obtains the optimum coating thickness range for the two friction partners.

No squeaking, no smacking – just heavenly silence

The chemists also support the application of the coating at the customer's site. E. g. an automotive supplier has just sent

several sample strips of a door trim foil. Such a lining consists of several parts: Armrest, decorative and light strips, and the actual trim. So there are numerous friction partners. If it is too high, the component no longer squeaks, but the door trim "smacks", as the customer describes the disturbing noise. Ultimately, for coating thicknesses outside the tolerance band, one noise is substituted by another. But the goal is complete silence for a noise-free driving experience.

“The stick-slip behavior is correlated to the applied coating thickness measured with the PaintChecker.”

Silke Elles

Chemist for anti-friction coatings, BECHEM

To achieve this, the automotive supplier has applied various thicknesses of the transparent anti-creak paint to the sample strips. For this purpose, a painting robot moved over the foils at different speeds. "The customer now wants to know at what speed he has to run his line in order to achieve the optimum coating thickness. And we can now reliably deter-

mine that speed thanks to the PaintChecker. It is the only device capable of measuring the coating thickness of this material combination. We can measure all the samples and pick out the ones with the best coating results" the head of solid film lubricant development explains.

The mobile measuring device on tour

The PaintChecker mobile Gun-B is optimized for non-contact testing of just applied powder coatings before baking. It measures the still soft powder layer on substrates such as metal, glass or plastic, independent of color and type. The shrinkage during baking is thereby taken into account.

Usually, the automotive suppliers apply the anti-creak coating in automated coating lines. "Ultimately, the coating quality depends on the programming quality of the industrial robot. The nozzles travel over the part at a predefined speed and apply the anti-creak paint. Whenever a paint robot changes direction and perhaps applies a second coat over a particular area, the coating thickness obviously changes as well," explains Paland.

A BECHEM technology manager accompanies the application tests on site and supports the customer in optimizing the respective coating line parameters. For this purpose he checks all plant parameters specified for this application and

“The PaintChecker Mobile is also used at the customer's site. For example, when a new system is to be installed or the coating is to be qualified for a new type of application due to a model change or facelift”

Florian Paland

Chemist and head of anti-friction coating development, BECHEM



The PaintChecker mobile family

Compact controller and ultra-light sensor

The complete measuring system consists of two units: The controller with the evaluation electronics and the lightweight, compact sensor as the actual measuring device. The tiny dimensions of the smallest sensor of 130 × 25 mm with a weight of just 50 g enable measurements in places that were previously difficult to access.

The right sensor for every task

The mobile OptiSense *laser models* are mainly used for smooth coatings on metallic substrates. Due to their tiny measuring spot, the slim laser sensors are particularly suitable for coating thickness tests on delicate small parts, corners and edges.

Due to the larger measuring spot, LED sensors are ideal for freehand measurements on rough surfaces. The *PaintChecker mobile Gun-R model* is particularly suitable for components made of plastic or rubber.

The *PaintChecker mobile Gun-B* is optimized for non-parts contacting tests of freshly applied powder coatings before baking. It measures the still soft powder coating on substrates such as metal, glass or plastic, independent of color and type. The shrinkage during the baking process is taken into account.

analyzes the critical areas of the part with the PaintChecker Mobile. "Let's stay with the door trim example. Here, the lock area is usually the critical one," Silke Elles points out. It is not uncommon that the line programming is adjusted by a more accurate set of parameters during the visit of the technology manager. The coating line then applies the anti-creak paint in the designated thickness to the entire batch.

Summary and outlook

"The fact that the OptiSense team has created a setting enabling the PaintChecker testing system to precisely measure the thin anti-creak coating on the extremely rough surface of the grained leatherette is unique. The colleagues in Haltern have done a really good job," compliments the chemist, who is already planning the future cooperation: "The next development project is already about to start; we are just waiting for some materials from the customer - and then the phone is guaranteed to ring again at OptiSense".

The BECHEM headquarters at night



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