Science around us

Innovations from BASF illustratively explained

BASF
The Chemical Company

Car finish: higher gloss and fewer scratches

BASF's iGloss® clearcoat provides long-lasting protection from microscratches

April 3, 2012
P 176/12e
Contact
Holger Kapp
Corporate Media Relations
Tel. +49 621 60-41040
Fax +49 621 60-92693
holger.kapp@basf.com

The color and gloss of an automotive finish play a major role in a potential car buyer's decision. Estimates suggest that one out of four car buyers is prepared to switch car makes due to a particularly attractive finish.[1] However, even the prettiest finish suffers from the many external impacts to which it is subjected over its lifetime. They include climatic influences such as sun, rain, snow and temperature fluctuations, as well as road salt, sap and bird droppings, all of which attack the paintwork. A further problem are the tiny scratches on the surface primarily caused in the car wash by the brushes and dirt on the car body. If the scratches multiply over time, the automotive finish can look dull and unattractive. The job of the clearcoat, the uppermost of the four layers of an automotive finish, is to offer protection from this mechanical wear and from climatic influences. In order for the clearcoat to fulfill its protective function, it must not be too hard or too soft. If the finish is too hard, it won't offer sufficient weathering resistance, and it will become brittle and quickly flake off. On the other hand, if it is too soft, it mostly stops protecting the finish from microscratches and chemicals such as fuels, which might wet the coating during refueling. With the innovative iGloss, BASF has developed an automotive clearcoat that offers the best of both worlds, providing the car with a glossy appearance for significantly longer than conventional coatings.

Final check in the varnishing line: the clearcoat as uppermost layer protects the automobile from external influences. With the clearcoat iGloss a car looks as good as new for longer.

Automated varnishing line: depending on the model, a car has a surface of 15 to 25 square meters that needs to be coated. The coating is in total a mere 100 to 110 micrometers thick.

Previous standard clearcoats for cars have consisted almost exclusively of organic material, referred to as polymers, which are long-chain branched hydrocarbons. In contrast, iGloss combines two kinds of materials in a nanostructured hybrid. Between 90 and 95 percent of the hybrid material, depending on the area of application, consists of organic material which forms the paint matrix. This makes the finish flexible and elastic and ensures a high level of weathering resistance. Five to ten percent of the inorganic material is embedded in the organic matrix. These silicate nanoclusters are particularly hard and scratch resistant. They consist of a small number of atoms and are distributed throughout the coating homogeneously and densely. The organic and inorganic components are covalently and thus elastically bonded. This allows the clearcoat to immediately spring back to around 90 percent, for instance, when hit by the bristles of a car wash brush. This is referred to as "elastic recovery" or "instant reflow" by paint experts. Conventional clearcoats ▶

[1] Source: Chemical Industry Fund within the German Chemical Industry Association in cooperation with the Deutsches Lackinstitut GmbH (German coatings institute – DLI), Frankfurt, March 2003.

BASF SE
67056 Ludwigshafen, Germany
Phone +49 621 60-0
Fax +49 621 60-20129
http://www.basf.com
E-mail: presse.kontakt@basf.com

Car finish: higher gloss and fewer scratches

only attain reflow rates of approximately 70 percent. With the new BASF clearcoat, the microscratches that occur are significantly flatter and therefore less visible.

“Over the course of five years of research and development, we have succeeded in combining the advantages of hard inorganic and soft organic materials,” said chemist Dr. Matthijs Groenewolt, who is responsible for developing iGloss at BASF. The special nanostructure of the coating does not form until the paint, with the addition of a hardener together with a catalyst, is baked on the surface of the car at a temperature of around 140 degrees Celsius. If needed, the lattice structure can also be formed at lower temperatures if the right catalyst system is selected. “This hybrid structure allows us to achieve a high level of long-lasting scratch resistance. In addition, iGloss is significantly more weathering resistant and more flexible than other highly cross-linked clearcoat systems,” Groenewolt added.

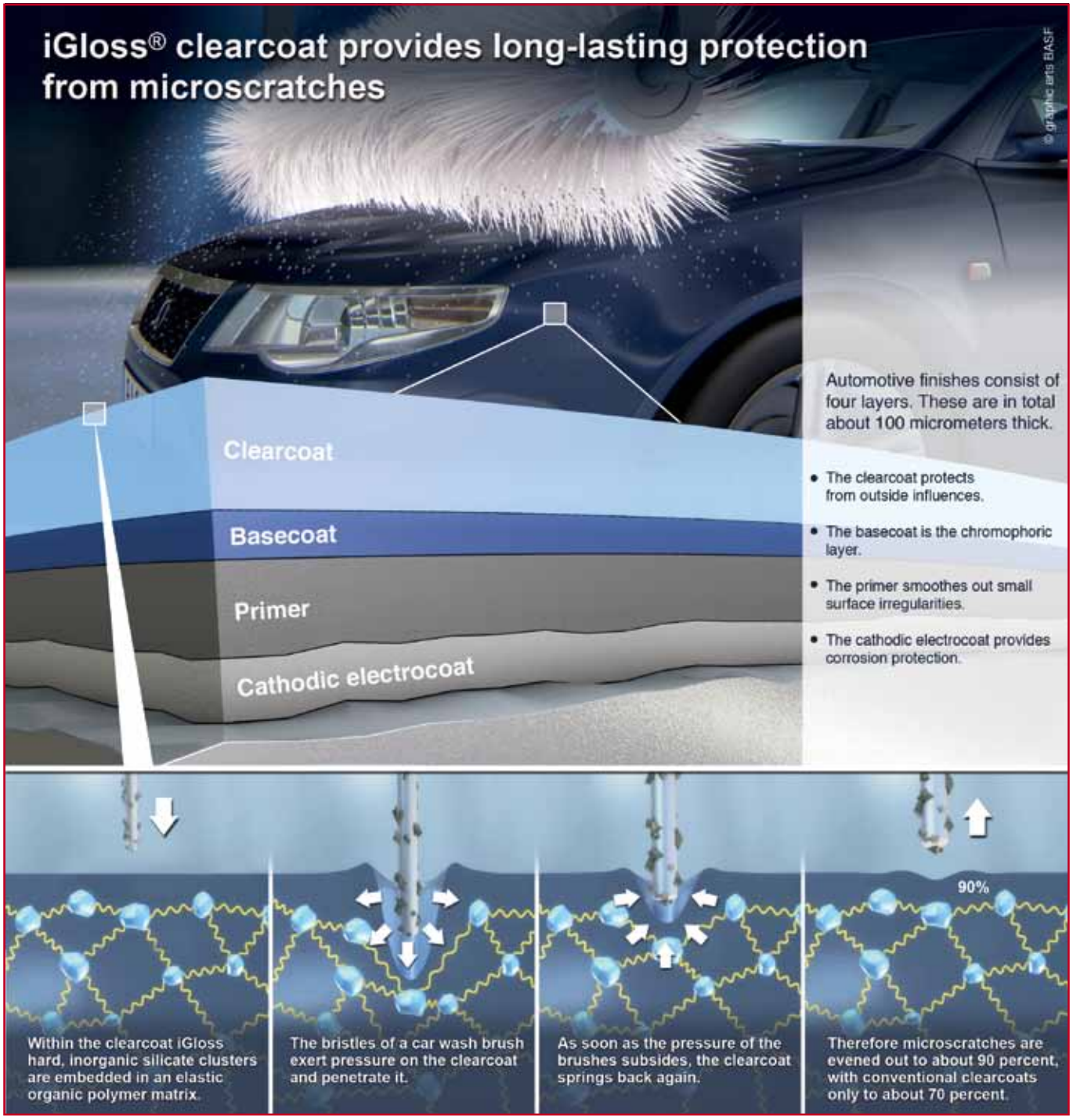
But there’s more to the innovative clearcoat than scratch resistance. It also offers superior weathering resistance, meaning the ability to withstand sun, rain and fluctuations in temperature. A lab test under extreme conditions with both very high temperatures and high radiation intensity showed the difference between iGloss and conventional clearcoats. Even after 4,500 hours, the new clearcoat retained most of its gloss. In contrast, other clearcoats became dull and showed cracks during this unusual stress test. The types of wear vary to which a clearcoat is exposed during weathering. While UV radiation emitted by the sun causes the formation of radicals and may degrade the polymer paint matrix, fluctuations in temperature lead to tensions in the material. Practical tests under everyday conditions with subsequent scratch tests confirmed the lab results: For surfaces finished with the BASF clearcoat, the gloss remains for about twice as long as with conventional clearcoats. That is good news for all car owners, not just because vehicles retain their new appearance for longer, but also because iGloss allows cars to maintain their value longer.

Despite its innovative composition, the clearcoat can be applied with the existing paintlines without requiring any major changes. This was confirmed by successful test runs at several automakers. After outstanding results during pilot tests, it has been used in mass production since mid-2011. Daimler is the first carmaker worldwide to use it, coating several models at its Bremen plant, including its Mercedes SLK. And other car manufacturers have expressed a great deal of interest as well. This means that in the future, other car models entering the market will be coated with the innovative highly scratch-resistant iGloss.

Science around us

Innovations from BASF illustratively explained

BASF
The Chemical Company



See Info Box ▶

Further information can be found at:

http://www.basf-coatings.com

Text, photos, graphic and animation with sound are available at: www.basf.de/science_around_us

Science around us

Innovations from BASF illustratively explained

BASF
The Chemical Company

The Info Box

The paint system of a modern automotive finish

Depending on the model, a car has a surface of 15 to 25 square meters that needs to be coated. A total of 12 to 15 liters of paint are needed for this job. The coating is a mere 100 to 110 micrometers thick, thus around one-tenth of a millimeter. This is comparable to the diameter of human hair (about 100 micrometers).

1. Cathodic electrocoat (e-coat): After the areas have been pretreated with zinc phosphate, first the e-coat is applied. To this end, the body is dipped in a bath with a waterborne dispersion (consisting of cross-linking agents and binders) for approximately three to five minutes. Then a direct voltage of 250 to 500 volts is applied to the body and a counter electrode located in the bath. Electrically charged paint particles are deposited on the body and form an approximately 20 micrometer thick coat there. Its primary job is to provide corrosion protection.

2. Primer: In the next step, the primer is applied. This approximately 30 micrometer thick polymer coat (often polyester or polyurethane) smoothes out small surface irregularities. For this reason, it contains inorganic fillers like kaolin, chalk or talcum. In addition, it improves adhesiveness and corrosion protection. Because this layer is particularly elastic, it prevents the paint from flaking off when it is exposed to stone chipping, since it absorbs and redirects the energy of the impact.

3. Basecoat: Now the basecoat is applied. This layer is also a plastic and usually consists of polyurethane. With a mere 15 micrometer film thickness, however, it contains the key elements determining the appearance of the vehicle: color and effect pigments known as metallic or pearl effects, whose elegant effect many car aficionados especially value.

4. Clearcoat: The single- or multi-component clearcoat applied in the final step is what creates the very tough and glossy protective layer. The job of this approximately 40 micrometer thick coat is to protect the finish from a variety of environmental influences. They include sun, rain, snow and temperature fluctuations, as well as air pollutants, road salt, sap and bird droppings, along with mechanical wear.

April 3, 2012
P 176/12e
Contact
Holger Kapp
Corporate Media Relations
Tel. +49 621 60-41040
Fax +49 621 60-92693
holger.kapp@basf.com