



What would a car be without its paintwork?

The history of automotive painting.

It's neither the engine, nor the dashboard nor the gearbox – no, what a potential car buyer usually sees first is the color of the car's shiny paintwork. Things were different in the early days of the automobile. Just like the technology under the bonnet, automotive coatings have come a long way from common black pitch to waterborne finish.

The first automobile, the Benz Patent-Motorwagen, was not painted. Karl Benz had the metal parts protected against corrosion with a kind of common black pitch. In these days, two basic products were used as paint: oil varnish based on linseed oil, or, if a special quality was required, amber varnishes obtained from liquid amber resins which were very expensive. The term "amber paint" continued to be used for a long time, even long after natural resins had gradually been replaced by synthetic ones.



Automotive painters originally produced their paints in-house – first manually, later with hand-operated paint mills. This was done in the same way as it had been done by painters throughout the centuries, i.e. by mixing binders and pigments on sandstone or marble slabs using a muller. Given that the paints were produced anew each time the pigments and the binders were mixed, the color shade was more or less a product of coincidence. While motorists were free to choose a blue, black, green, brown, beige or red car, it was impossible to specify the exact shade. All colors had a relatively earthy shade, as only mineral paints existed, which contained inorganic pigments. White lead paint and mineral red were used as the main anti-corrosion pigments.

In the early days of automotive engineering, the parts that had to be painted were the chassis, the bonnet and the body. Before the paint was applied, the surfaces had to be smoothened, as the sheets were beaten by hand or with a mechanical hammer. It took between four and eight weeks to coat a complete car. Several primer applications and a few intermediate coats with generous drying times were required. There was also a simple, faster-drying coating process based on wood oil, which took "only" about ten days.



Prestige and Classic Cars.

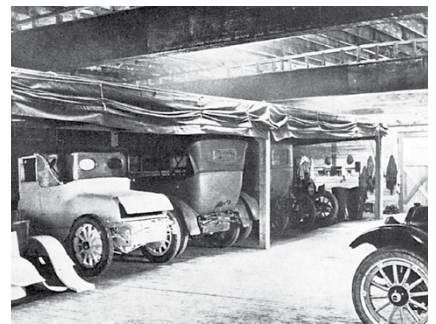


Mass painting.

In 1913, Henry Ford had the first car produced on the assembly line. This approach changed the entire production process. Ford realised quickly that the painting process was a hindrance, as the painters could not keep pace with the fast pace of the assembly line. He therefore looked for a possibility to accelerate the painting process.

But it was only after the First World War that researchers discovered a new material for the production of paint – nitrocellulose, which had been left over from gunpowder production during the war. It was possible to process nitrocellulose into paint binders. Moreover, chemists were now able to produce plasticisers, some solvents and synthetic pigments on a large scale. The result were matt nitro paints offering short drying times (approx. 15 hours). The drying time could be reduced even further with the help of hot air. Polishing paste and a linen cloth were then used to polish the matt paints until they shone – a shine that has been unmatched by any topcoat system to date. Prep materials – such as adhesion primers, fillers and putties – were also produced on the basis of these binding agents.

The main requirement for processing nitro paints was the use of a spray gun, as the solvents contained in these paints dissolve the coating underneath. They cannot be processed using a paint brush. What is more, all surfaces must be cleaned and degreased thoroughly, as nitro paints are very sensitive to grease residues and are characterised by fairly poor adhesion. Nitro paints still offered a very limited range of shades. With most car makers, customers could choose between red, blue or green, and the result was not guaranteed and standardised as is the case today. The first covering white pigment, titanium dioxide, was used in 1928 and quickly became the most popular color for sports cars and other open-top automobiles in the 1930s. But the joy did not last long, as nitro paints are not weather-resistant. The constant decomposition of the binding agent quickly resulted in a dull look and frequent repolishing wore away the topcoat layer.



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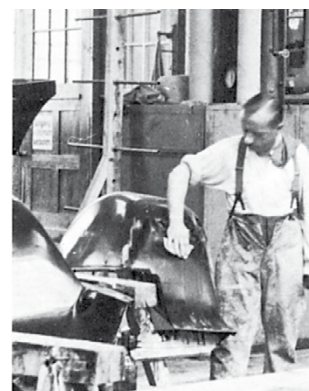
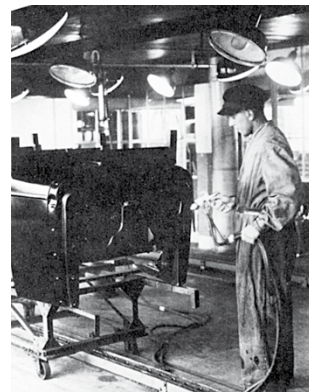
Nitro combination paints.

As the development of the vehicle bodies continued, the coating technology changed, too. In 1927, a new binder, alkyd resin, had been developed in the USA, where it was called glyptal. After it had been modified with fatty acids, it was possible to use this resin as a resin for lacquers. Alkyd resin coatings can be combined with nitro cellulose and could thus be used as elastifying components in nitrocellulose paints – this mixture was later commonly known as nitro combination paint.

In the 1930s, melamine resins and urea resins were developed, which did not yellow so quickly and were combined with alkyd resins to produce lighter shades. From 1935, these modified alkyd resin paints became increasingly widespread as they produced a harder surface than nitrocellulose paints and did not have to be polished. What was more, only half of the material was needed compared to the paints previously used.

Thanks to the new material and the modified technology, it took only just under four hours to coat a new vehicle body – provided that deep-drawn sheet metal was used, which did not require any putty work. The colors changed, too. At the 1946 Auto Show in Paris, colorful automotive coatings were displayed for the very first time, which had become possible thanks to the new organic pigments. Vehicle coatings were also influenced by the silver-colored racing cars that were so successful at the time. For some time, it was very much en vogue to have a silver or silver-grey car.

After the Second World War, alkyd resins became almost ubiquitous in Europe, given that they allowed the then state-of-the-art alkyd melamine resin baking coating process to be performed on the assembly line. Primers and fillers were applied in a high-pressure spraying procedure, even though individual manufacturers already dipped their bodies-in-white in the late 1950s. Nitrocellulose paint was maintained only for very expensive luxury sedans until 1963/64 in spite of the increased care required for this kind of finish. Alkyd resins are so chemically flexible and exhibit such a high quality that they have played a major role in automotive coating until today. Soon after their introduction, they dominated the paints market in the field of refinishing too.



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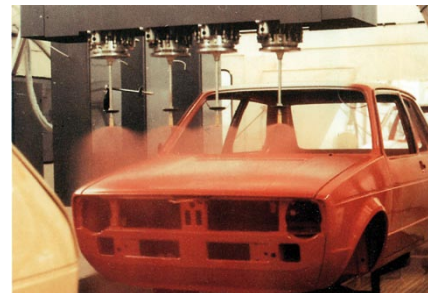
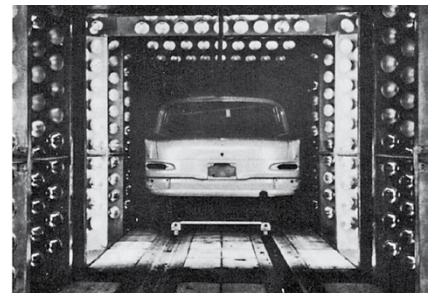
New materials for paints.

From 1963, polyester was the new material available to the paints industry. Polyester became indispensable particularly as a basis for stoppers, while nitrocellulose and synthetic resin stoppers became less important. The ingredients of topcoats changed, too. Alkyd resin paints were now mixed with isocyanates that accelerated drying even at room temperature compared to alkyd melamine resin paints. Forced drying in a combined spray booth and low bake oven enabled the automotive painter to save a lot of time with the new paint system, so that these booths soon became an economic necessity for body-shops.

Between 1972 and 1975, the 2K acrylic polyurethane technology (acrylic base and polyisocyanate hardener) almost completely pushed alkyd resin paints out of the market. These 2K systems for the topcoat layer were characterised by a much higher chemical and physical resistance. The paints dried quicker and allowed dust inclusions and sagging to be polished out. From the early 1970s, the paint manufacturers also developed a primer filler that protected against corrosion to make special corrosion protection paints superfluous. In the 1980s and 1990s, coating remained one of the most time-consuming processes in automotive production. Until today, electrostatic rotating atomisers have been used in OEM coating to apply the filler and the topcoat to the prepared car body. This saves a lot of material, because now 90 percent of the paint used are actually applied to where it belongs, on the automotive body.

By contrast, half of the material was lost as overspray in the conventional high-pressure spraying process. Since the mid-1980s, OEM coating has become almost fully automated and is today largely performed by robots. Only small areas remain to be painted manually: interior parts like the engine compartment and the trunk, hood and doors are sprayed with the gun first.

In the 1980s, a number of hazardous paint ingredients were replaced as paint manufacturers and car makers increased their environmental awareness. In addition, the share of organic solvents in the paints was reduced, because these substances are blamed for causing summer smog and other nuisances. 2K acrylic paints were developed further into low-solvent high-solids, i.e. paints with a lower solvent content

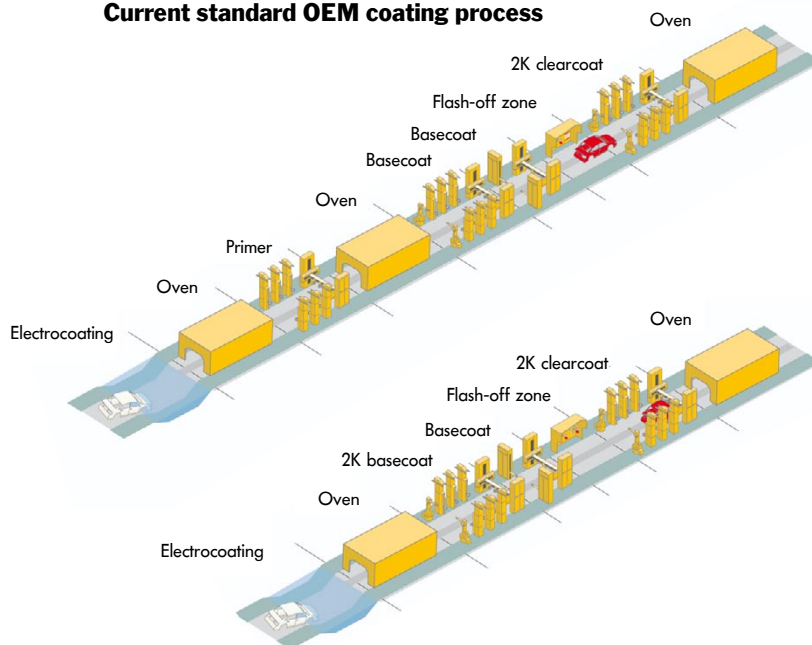


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and a higher share of solid particles. The mid-1980s also saw the launch of the first waterborne paints, which have since become the standard type of paint both in OEM coating and refinishing.

Current standard OEM coating process



DuPont EcoConcept

Primerless automotive coating

Contemporary OEM coating is characterised by high expectations in terms of the looks and quality of the finish. Within the framework of its EcoConcept, DuPont has developed a procedure in which the function of the filler is performed by special basecoats. The advantage for automotive manufacturers: as the primer coat is no longer required, the coating process is shortened and the capacities of the primer coating systems and drying ovens can be used for other tasks. In the field of refinishing, however, fillers will continue to fulfil their many (unseen) tasks for a long time to come.



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