standothek

How to refinish plastics.

STANDOX

The Art of Refinishing.

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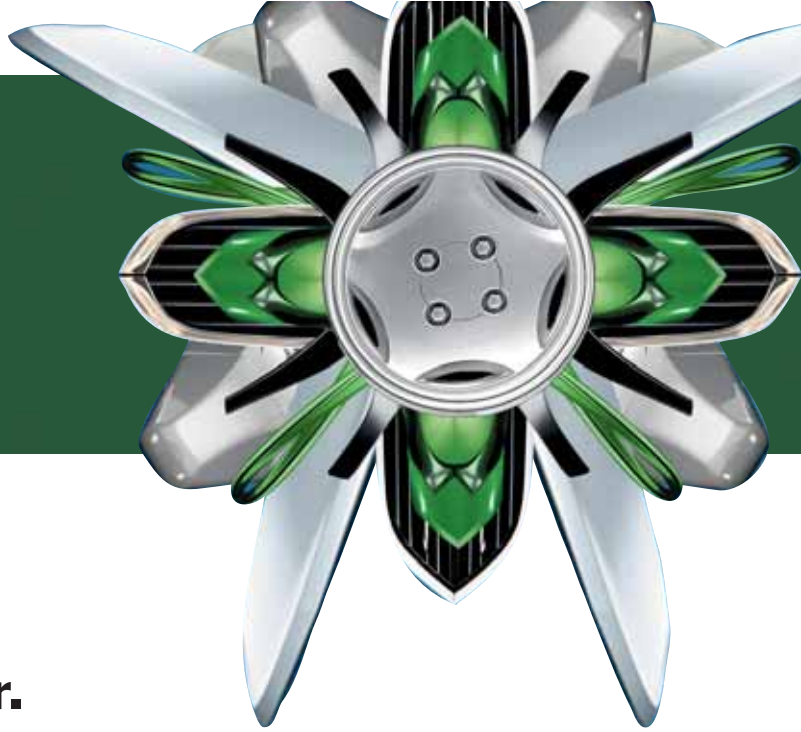


Plastics:
An exemplary career.

In addition to such terms as the “industrial age”, the „nuclear age“ or the “space age”, our era should really also be described as the “plastics age”, for quite a few achievements would have been virtually impossible without the invention of plastics.

In 1862, a British scientist, Alexander Parkes, invented a hard ivory-colored material which he called Parkesin. A long, stony road lay between this first plastic material and the use of modern plastics in motor cars but that is a different story altogether.

The first plastic material was invented 27 years before Gottlieb Daimler presented his vehicle with steel wheels to the general public and laid the foundations for today’s automobile industry.

Plastics have been an indispensable element in modern motor vehicles for several decades. For a long time, they were only used for the passenger compartment and such classical external components as bumpers, spoilers or mirror housings, but nowadays they are also used as body panels. Doors, wings and bonnets are increasingly made from different types of plastics and must be repaired when damaged.

One plastic is not the same as the next, so the challenges facing refinishers are consequently growing, together with the need for detailed information on the use of plastics on motor vehicles. The first question to be answered is therefore: “What are plastics?”

A wide variety of terms are used in everyday life to describe one and the same thing, such as plastics, rubber and synthetics as well as PP/EPDM, polyamide and ABS.

Some of these are merely overall terms for plastic materials in general, while others refer to specific plastics with different properties. It is exactly these different properties which may lead to unpleasant surprises when refinishing plastics.

As early as the late 1970s, Standox launched a compact yet complete plastics refinishing programme, which has been improved and refined over the years in close cooperation with the automotive industry. The programme provides bodyshops with proven products that ideally meet their day-to-day requirements. In special training courses and workshops, refinishers gain valuable knowledge on how to handle automotive plastics.

Rough overview of different plastic types.

Plastics are made up of individual components known as molecules. These molecules can be strung together in large numbers to form long chains known as macromolecules.

Thermoplastics.
Thermoplastics is the name given to plastics made up of separate linear or branched macromolecules which, however, are not linked together.

Due to their many positive properties, thermoplastics are the most commonly used plastics in vehicle manufacturing.

Thermoplastics can be melted and reused several times. This is an important factor where environmental protection is concerned. Provided that different types are not mixed together, thermoplastics are ideal materials for recycling, because theoretically new parts can be made from old parts.

Another advantage is that cracks and fractures can be sealed by welding

Elastomers.
"Cross-linking" is the term used when macromolecules are linked together more or less strongly. When only a small number of individual molecular chains are cross-linked with neighbouring chains, elastomers are formed.

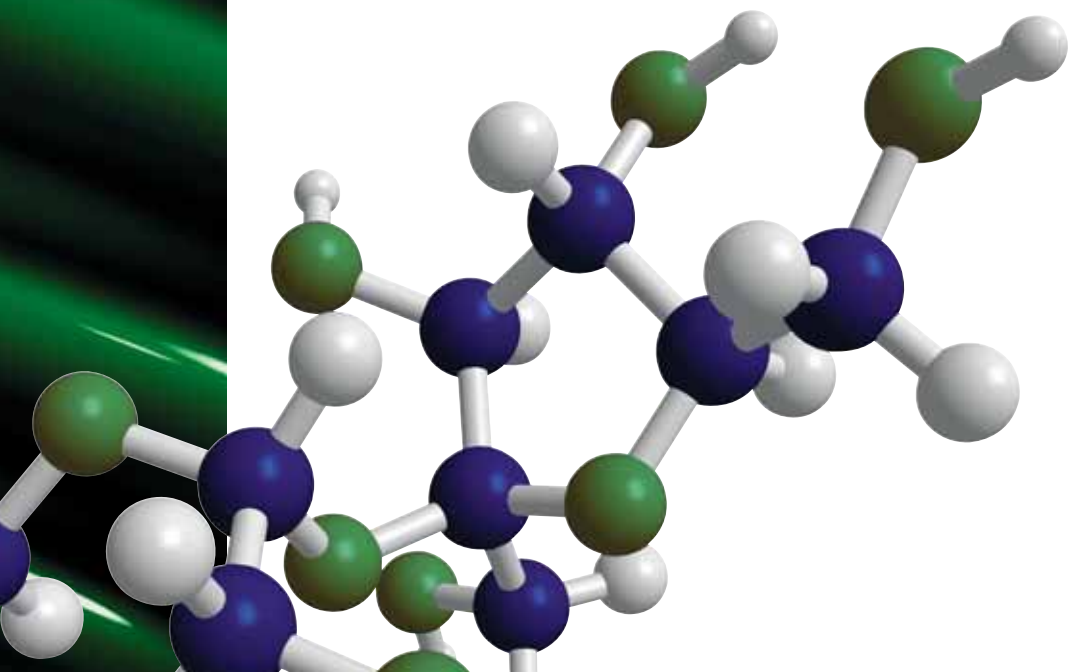
Elastomers cannot be melted and reused, although they can still expand and display rubber-like properties.

These materials are used for gaskets and spoilers on motor vehicles.

Thermoset materials.
As the number of cross-links increases, the material becomes harder and more brittle. The numerous molecular chains now form a single network. These extensively cross-linked plastics are known as Thermoset Materials.

They cannot be welded, dissolved or expand like elastomers.

Instead, thermoset materials are highly resistant to heat and this is why they are used for housings in the engine compartment, for example.



Plastics are indispensable.

There are many reasons for using plastics in automotive engineering. Most importantly, they help reduce vehicle weight without compromising on safety. In addition to purely functional aspects, however, plastics also play a major part with regard to the shape and design of a motor vehicle.

The percentage of plastics used in vehicle manufacturing has more than doubled since the 1980s. Researchers and developers assume that by the year 2010 one in six kilogrammes of a vehicle`s weight will be accounted for by plastics. The percentage of plastic body parts is growing constantly due to new materials and composites. Instead of producing the spoiler, radiator grill, bumper and wing separately, as in the past, these four parts are now combined into a single integrated side-and-front element.

The possibilities for shaping and processing plastics are virtually unlimited. This not only opens up new possibilities for the designers, but also permits considerable savings in fuel consumption. The weight of a car door made from composite materials is easily 10% lower than the weight of a „traditional" metal door. This shows that plastics make an important contribution to reducing fuel consumption. Rule of thumb: A 100 kg reduction in weight saves 1 litre of fuel over 100 km.

But plastics have even more advantages. Due to the elasticity of the materials, for instance, minor damage is reduced. Other benefits include greater occupant comfort, reduced noise emissions and a longer vehicle life.

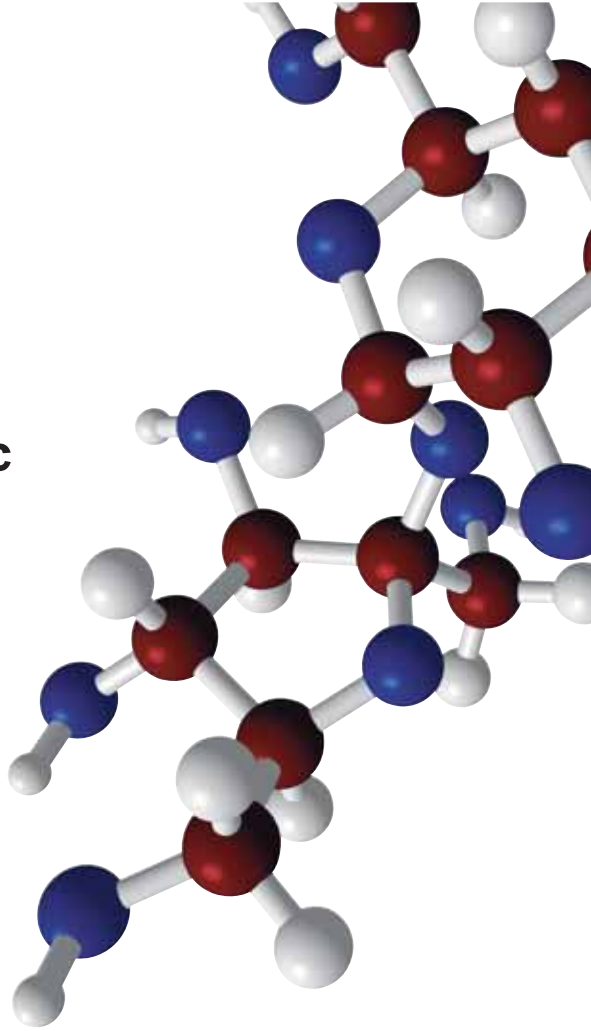
In view of these positive properties of plastics, the trend in vehicle manufacturing is towards body shells that can ideally be combined with plastic body parts.

From market niche to mass market.
"Pimp my car" - the tuning scene is increasingly relying on plastic body parts.

It all began in the 1990s, with plastic add-on parts such as spoilers, air scoops and side skirts. Notwithstanding some ups and downs, this trend remains with us today. Plastics are easily moulded into ever more extreme body transformations leading to the development of exotic designs produced in limited – and sometimes tiny – production runs.

green: typical plastic parts such as wheel covers, bumpers, mirror housings, side skirts, trims.

blue: optional plastic parts such as bonnet, mudguards, doors.

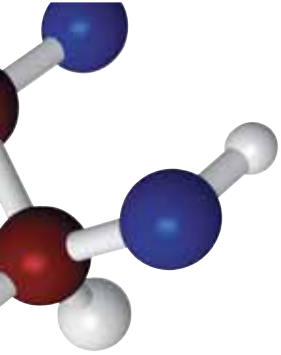


Automotive plastic types.

“Blends” (e.g. PP/EPDM) are frequently used in addition to the pure form. A blend is a mixture of different plastics and corresponds to an “alloy” in metals.

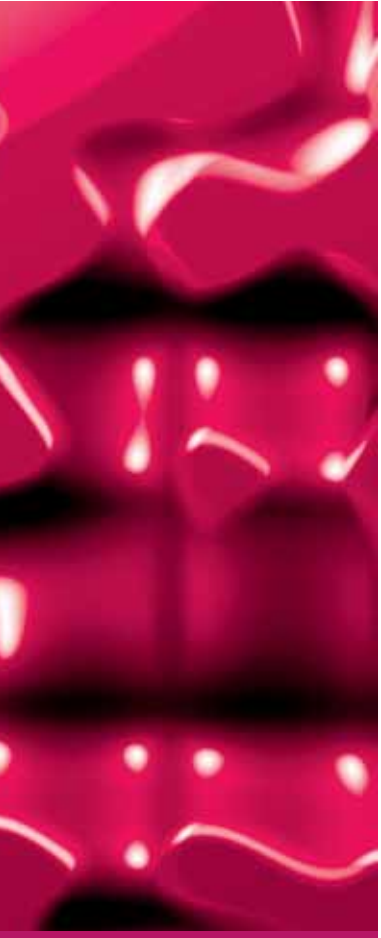
“Blending“ allows for several desirable properties to be combined in a new plastic material.

The trade names coined by the individual plastics manufacturers are also commonly used, but rarely give any direct indication of the type of plastic involved.



Acronyms of frequently used plastics.

Chemical name	Acronym	Trade name(s)	Automotive parts
Polypropylene/Ethylene-propylene-diene-copolymer	**PP/EPDM**	Stamylan P, Sabic PP, Purell, Novolen, Moplen, Kelburon, Hifax, Forprene	Bumpers, rear spoilers
Acrylonitrile butadiene styrene copolymers	**ABS**	Bayblend, Relac, Magnum, Lustran ABS	Mirror housings, wheel covers, roof box, front and rear spoilers
Polyamide	**PA**	Minlon, Akulon, Zytel, Vestamid, Ultramid	Wheel covers, fuel filler flap
Polycarbonate	**PC**	Makrolon, Xenoy, Lexan	Bumper panels, radiator grilles
Polyphenylene oxide	**PPO**	Noryl, Laril	Body parts, e.g. mudguards, hatchbacks
Acrylonitrile-styrene-	**ASA**	Luran S, Kibilac, Geloy	Radiator grilles, front and rear spoilers
Styrene-acrylonitrile	**SAN**	Luran, Tyril, Lustran SAN	Radiator grilles, front and rear spoilers
Polyurethane	**PU**	Bayflex, Baydur, Irogran, Estane	Bumper elements, rear spoilers
Polyethylene terephthalate	**PBT**	Pocan, Crastin, Ultradur, Vestodur	Body parts, e.g. mudguards, hatchbacks
Unsaturated polyester	**UP**	Roskydal	Hatchbacks, truck add-on parts, sports car parts
Epoxy resin	**EP**	Araldit	Components for racing cars
Polyvinyl chloride	**PVC**	Vestolit, Solvic	Tarpaulins, bumper strips



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Important plastic types in detail.

PP **Polypropylene**
PP/EPDM **Ethylene-propylene-diene-copolymer**

Body parts made of this material are usually manufactured as blends. Complex injection-moulding plants are required for manufacturing large parts. For this reason, they can be produced particularly cost-efficiently in the large numbers required by the automotive industry.

Depending on the composition in each case, unprimed PP or PP/EPDM can cause problems with regard paint adhesion.

PP was for many years considered impossible to refinish by bodyshops on account of its non-polar nature. Standox played a pioneering part in solving this problem with the development of its Standoflex system. Thanks to ongoing research and development, Standox is today still regarded as an expert in the field of plastic refinishing.

ABS **Acrylonitrile butadiene styrene**

ABS plastics are both tough and rigid. They owe their toughness to the rubber component (butadiene) and their rigidity to the acrylonitrile component.

Parts made of ABS materials should not be left out-of-doors without protection and exposed to UV radiation for any length of time. Like all plastics containing rubber, they gradually lose their toughness and become brittle.

PA **Polyamide**

Wheel trims are now made almost entirely of PA, a tough and resilient material with high rigidity and strength. PA is largely resistant to most organic solvents.

Molecular water is reversibly bound within the molecular structure, i.e. it absorbs water from the ambient air and releases water to the ambient air. This explains many of the material`s positive properties, although it can have an adverse effect on the adhesion of a coating, as the water may deposit directly on the surface.

PC **Polycarbonate**

This thermoplastic material features several outstanding properties, some of which are also obtained with other plastics, but which are only found in their entirety in polycarbonates. These properties include:

- High mechanical strength, even at very low temperatures (down to –100 °C).
- Good resistance to weathering.

ASA **Acrylonitrile-styrene-acrylate**

ASA forms a brilliant and scratch-resistant high-quality surface and can also be made transparent. Matt surfaces can be produced with the addition of matting agents.

ASA is characterised by excellent resistance to liquid substances including aggressive chemicals. ASA is also highly resistant to oils, fats, etc.

PU **Polyurethane**

All these plastics are structural foams, the hardness and flexibility of which can be varied extensively. Structural foams have a cellular core that becomes more and more compact the further it is from the centre and which is virtually sealed on the surface.

Flexible PU foam has an extremely elastic core with very high resilience, i.e. the material will return to its original shape even after an extended period of deformation.

TPU **Thermoplastic polyurethane**

RTPU **TPU, Reinforced thermoplastic polyurethane**

RTPU and TPU are recyclable thermoplastics. This is an increasingly important advantage for the automobile industry, particularly in times of strict recycling regulations.

Parts made from these thermoplastics display all the various properties characteristic of every polyurethane:

- High rigidity.
- Dimensional stability under heat.
- Good low-temperature impact strength.
- Can be coated.
- Resistant to corrosion.

UP **Unsaturated glass-fibre-reinforced polyester**

BMC **Bulk Moulding Compound**

SMC **Sheet Moulding Compound**

UP-GF was better known as GFK (glass-fibre-reinforced plastic) for a long time. However, these materials must now be differentiated more accurately, since numerous plastics are reinforced with glass fibre.

The use of glass-fibre-reinforced UP for large body parts, such as bonnets, boot lids or wings, is common practice for low volume production and in the tuning sector.

SMC and BMC are the most commonly used processes employed by the automotive industry.

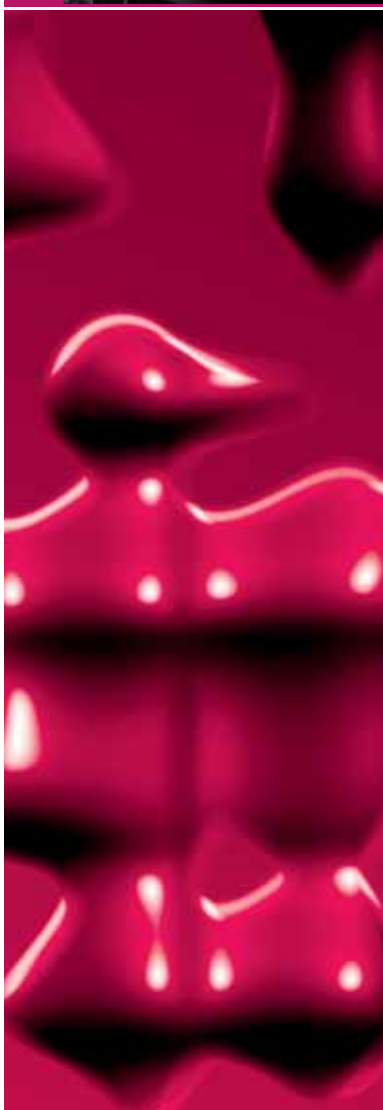
BMC comprises chalked-filled UP resin and chopped strands. The plastic parts made from this material are injection-moulded under high pressure and high temperature.

SMC are sheets and panels of polyester resin with two-dimensional glass fibre reinforcement, which are moulded under pressure and at high temperatures.

Carbon fibre is characterised by its high strength and low weight as well as by its attractive appearance. Due to the high manufacturing costs, carbon fibre is normally used only in motor sports and for premium priced cars.

PVC **Polyvinyl chloride**

PVC is one of the most versatile plastics due, not least, to the fact that it can be produced with a wide variety of properties, from rigid to rubbery.



Why paint plastics?

Although plastics can now be produced in all colors and with a matt or a glossy surface, in many cases they still have to be painted.

On the one hand, plastics must be painted for aesthetic reasons:

- Individual coloring to match the paintwork of the vehicle body.
- More gloss or color brilliance by adding.
- Elimination of manufacturing defects.

At the same time, the plastic material must be protected, because it is exposed to the elements day after day and will age as a result.

It is almost impossible to imagine plastics corroding or degrading, but like most other materials, they also age and degrade when exposed to moisture and UV light.

Factory-finishing plastics by the automotive industry or its suppliers is a standard, high-volume operation using parts identical in shape and made of the same plastic material. Refinishers, on the other hand, are faced with a number of basic problems:

- The parts are not identical or even similar; they are always made of different types of plastics with different design and functions.
- Bodyshop conditions and resources may vary considerably.
- The parts are presented in different conditions, i.e. as new or repaired parts.

Since the 1980s, plastic components have been marked on the back in accordance with VDA Recommendation 260*. The acronyms used are standardised in DIN EN ISO 1043-1 and DIN ISO 1629.

***) Distributor:**
DOKUMENTATION KRAFTFAHRWESEN e.V. (DKF)
Ulrichstr. 14, D-74321 Bietigheim-Bissingen

Now that the type of plastic is identified, it has become easier to draw up specific recommendations for painting the plastic concerned.

Consult the practical section for further information on how to deal with older vehicles containing unidentified plastics.

In some cases, the carmakers specify that certain components must not be coated for functional reasons. Such restrictions must always be observed.

Example: Motorcycle helmets:
Many helmets are made from polycarbonate (PC), a highly shock-resistant plastic that can be coated using suitable paint materials.

Polycarbonate is highly sensitive to solvents. Unsuitable cleaners or paint materials may harm the polycarbonate and lead to microcracks in the plastic material. As a result, the protective function of the helmet may be affected and the helmet may break in a crash.

Abbreviation for the main component contained in the plastic.

Filler or reinforcing materials, possibly proportion of filler or reinforcing material.

>PUR-GF18<

>PP+EPDM TV20<

Plastic parts in the bodyshop.

Before starting to refinish a part, the refinisher should observe a few important basic rules and thoroughly inspect the plastic part concerned. Is it an old or a new part? Painted, primed or untreated? Answers to all these questions and more can be found in the following paragraphs.

Painted old parts.
Old parts which have already been coated must be carefully examined:

- Is the part damaged?
- Does the paint film adhere everywhere?
- Are there any cracks to be seen?
- Is the paint resistant to solvents?

It goes without saying that any defects found must be repaired before continuing, provided that the effort required does not exceed the cost of a new part. This is then followed by: cleaning, sanding, renewed cleaning and finally application of the paint.

Repairing damaged plastic parts:
Special repair kits approved by car makers for repairing damaged plastic parts are available for most materials. Minor scratches can be eliminated quickly and easily with a suitable fine stopper.

Plastic-welding is the ideal method for repairing thermoplastics, although thorough training and a detailed knowledge of this technology are essential.

Unpainted old parts.
Such parts constitute the most critical substrates, since their history will always remain unknown to the refinisher.
What has happened to the plastic since the vehicle was delivered to its owner?

- Has it been looked after?
- If so, what care agents were used and how?
- Has the plastic material absorbed wax or silicone from polishes or preservatives?
- Can these agents be removed?

These questions cannot always be answered retrospectively, with the result that adhesion of the refinish may be impaired in spite of thoroughly preparing the part and ensuring that it is apparently as clean as possible.

The risks of old plastic parts relate to their unknown history. Utmost care and great experience is required to avoid mistakes when refinishing such parts.

Uncoated new parts.
The most important rule to be observed is that:

The substrate must be free from release the agents!

Clean the parts thoroughly in accordance with the Standox TDS recommendations. Standox can offer the ideal tailor-made or universal systems for the subsequent coating process. For more tips on how to remove the different release agents, please see the following pages.

Coated new parts.
If the existing coating is found to be intact, coated new parts can be refinished without difficulty.

After sanding and carefully cleaning the part, it can be coated directly with Standox topcoat or Standox clearcoat. Topcoats and clearcoats should be plasticised by adding the respective additives to match the flexibility of the plastic material.

Primed new parts.
The primers used here differ considerably, and their composition and suitability for subsequent processing remain unknown. Preliminary tests are recommended and the manufacturer`s instructions (e.g. those enclosed with the product) can prove useful.

If unknown primers from other manufacturers have been used and information for further processing is not enclosed with the plastic part, it is impossible to make any reliable assessment of whether or not certain criteria are met, such as:

- Adhesion between primer and plastic.
- Suitability for coating with primer fillers, topcoats or other Standox products.
- Appearance in the paint system, e.g. sinkage or lifting.
- Elasticity in the paint system.
- Redissolving when cleaned.

In this case, please note the manufacturer´s refinishing recommendations.

Getting paint to adhere on plastics.

The release agent used to free plastic parts from the mould will also release your paint coating from the plastic. Plastic parts are primarily injection-moulded or reaction injection-moulded with the aid of complex moulds and presses, as well as other highly sophisticated tools. Very high production rates can be achieved in this way. Release agents are used to ensure that many parts can be taken from one mould without difficulty. Some of these release agents stubbornly adhere to the plastic. Release agents come in three different types and can make life difficult for the refinisher.

External release agents.

- Conventional release agents are based on wax and oil, dissolved in organic solvents. They can be removed in the bodyshop with suitable organic thinners and a sanding pad.

- Water-thinnable emulsions of release agents are based on wax and oil, i.e. emulsified in water. These can be removed in the bodyshop with suitable organic thinners and a sanding pad. **Water-thinnable release agents cannot be dissolved in water.**

Internal release agents.

Self-release products contained in the plastics blend are used in what is known as the IMR process.
Zinc stearate is the main chemical concerned. Parts must be conditioned before being cleaned. Can be cleaned with organic solvents or thinners and a sanding pad.

Release paints.

Chemically speaking, release paints are a polyvinyl alcohol dissolved in water. Such parts are only encountered in negligible percentages and are easily identified by the wavy rear. These parts must always be cleaned with water first.
Polyvinyl alcohol can only be removed with water and is insoluble in organic solvents.

How to remove release agents from plastic parts.

Conditioning.
Conditioning (i.e. warming up) the parts before they are cleaned can be useful for the following reasons:

- The heat helps the part "sweat out" release agent (particularly important in the case of PU materials).
- Stresses in the plastic material are relieved in order to prevent cracking.
- Voids (trapped air) can be identified and treated (opened and filled with stopper) BEFORE the part is coated.

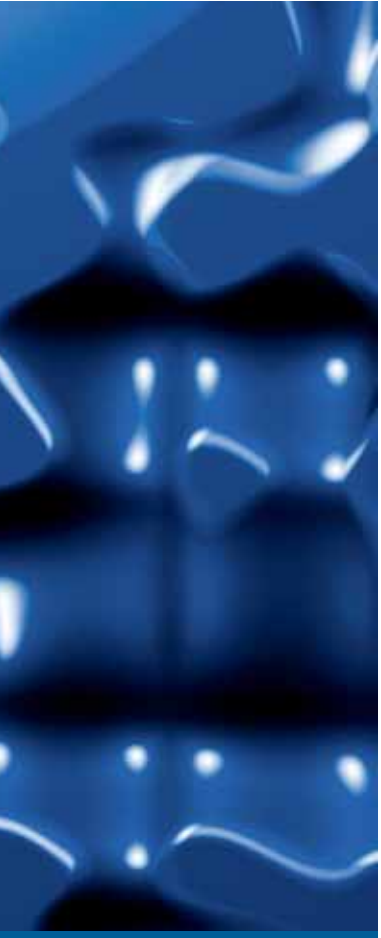
If necessary, the parts must be supported in order to avoid deformation.

Cleaning.
Repeated cleaning is imperative. Intensive, repeated cleaning with pad, brush and fresh cleaning agent is absolutely essential in the bodyshop.

Simply wiping clean once is rarely sufficient, even if the recommended cleaning agents are used.

Textured parts must be cleaned more intensively. Release agents and dirt must be removed from textured plastic parts using a soft brush or high-pressure cleaner.

After cleaning the plastic parts, it is absolutely essential that the cleaning agents evaporate entirely before further processing.



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Causes of refinishing flaws.

Mistakes are made everywhere, but knowing where to look cuts down on problems and complaints. Remember that rework costs a lot of time and money.

Inadequate preparation (conditioning, cleaning).
Inadequate preparation is the commonest mistake and can have various consequences. For example:

- Surface defects due to release agent residues.
- Chipping, since the coating is applied to a release agent which is designed to prevent adhesion.
- Cracking if stresses present in the plastic material are not relieved.

Any time saved by not conditioning or cleaning a part correctly will often be lost by expensive rework. And this is not counting the loss of goodwill from a complaining customer.

Unsuitable cleaning agents.
Highly corrosive cleaning agents can damage plastics such as ABS, PC, PPO, etc., which are not resistant to solvents, and lead to cracks or even destroy them entirely. Standox has developed specially tested cleaning products to prevent this happening.

Applying the coating too soon after cleaning.
The solvents absorbed by the plastic material when it is cleaned must be removed completely before the coating is applied, otherwise they will cause a build-up of vapour pressure between the plastic and the coating, ultimately reducing the adhesion. The risk of solvent popping and pinholing is also increased.

right: Orange peel caused by unsuitable solvent combination.

beneath: Poor adhesion caused by insufficient cleaning or unsuitable adhesion promoters.

above: Pinholes are caused when the paint is applied too soon.

left: Lifting caused by improper isolation and/or through-sanding.

Unsuitable coupling agents.
It has repeatedly been mentioned in the preceding chapters that there are many different plastic materials and that each material has specific properties.

Standox has the experience and the products needed not only for refinishing jobs in the bodyshop, but also for high-volume factory finishes, possibly with precisely defined specifications to meet.

Too little plasticiser.
Topcoats and clearcoats must contain the right amount of plasticiser. Too little and coatings usually crack under mechanical strain. In any case, please note the Technical Data Sheets.

Tip: The Standothek brochure entitled **"Identifying and Eliminating Paint Defects"** provides an overview of the most common defects and tips on how to assess and avoid them.

Reliable color matching for plastics.

A perfect refinish on plastic components is the result of skilful workmanship, correct preparation and the exact choice of color. Standox offers refinishers many useful aids for precise color matching.

Plastic add-on parts on modern cars are usually painted in the same color as the car. In this case, the same color can be used with the addition of a plasticiser. The situation is not that easy when add-on parts are coated in a different color, which is often the case on old cars or with decorative parts of current models.

In the case of a smooth, glossy surface, Genius and Standowin help refinishers determine exactly the right color shade. Based on precise electronic measurement, Standowin will offer the best matching color formulation.

If and when no electronic colorimeter is available, refinishers may use the color information on the Standowin CD or the color search on the Internet, which is accessible via the Standox website of each country. Here, they will find special programs to suggest the right color formulation for each model and the respective add-on parts.

Tip: The Standothek brochure entitled **"The quick way to a perfect color match"** provides valuable information on how to find the right color sheet.

Technical Data Sheets and refinishing systems.

Please contact your Standox representative for the latest Technical Data Sheets and other information on the Standox refinishing systems. The current Data Sheets are also available on the national Standox websites.

Standox GmbH · Postfach · D-42271 Wuppertal · Germany

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