WELCOME TO THE
WORLD OF
KABE FARBEN

Identifying coating errors and avoiding them

Application Technology – Basic Course for powder coating operators

Powder coatings
kabe-farben.ch

KABE Farben
KARL BUBENHOFER AG

TABLE OF CONTENTS

KARL BUBENHOFER AG | Hirschenstrasse 26 | 9201 Gossau SG, Switzerland
T +41 71 387 41 41 | info@kabe-farben.ch | kabe-farben.ch

A company of the **KABE** SwissGroup

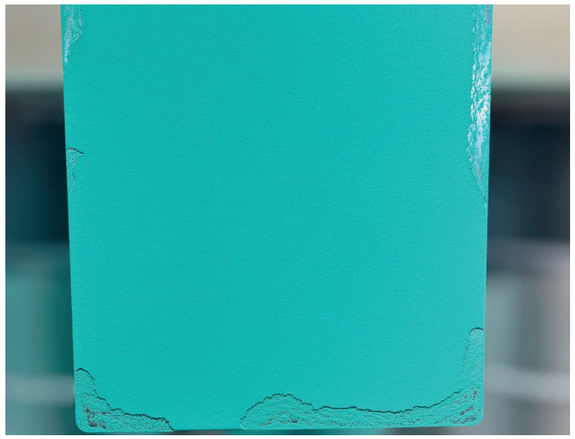
Powder coatings | Paints + plasters
Facade insulations | Industrial coatings

APPLICATION

Powder trickling off the workpiece

Characteristic:
Even the slightest vibrations cause the powder to trickle off the workpiece, making it impossible to achieve sufficient layer thickness.

Cause	Corrective Action
Poor earthing	Check contacts, especially hangers and hooks
Insufficient charging	Increase voltage, reduce powder output
Particle-size distribution too coarse	Contact powder supplier
Particle-size distribution too fine	Add more fresh powder, contact the powder supplier
Layer too thick	Reduce powder output
Excessive air flow (blow-off effect)	Reduce air flow



Poor wraparound

Characteristic:
No or only minimal film thickness on the reverse side during single-sided application processes.

Cause	Corrective Action
Poor object earthing	Check hangers and hooks
Air flow too high or too low	Optimise air flows
Powder output too high or too low	Optimise air flows
Faulty gun	Contact the system manufacturer
Insufficient powder charging	Contact the powder supplier
Particle-size distribution not suitable	Contact the powder supplier
Unsuitable object positioning	Optimise object suspension

Layer thickness too thick

Characteristic:
Before curing, a spray-back effect and an uneven surface are visible; after curing, poor flow (long-wave) and an orange-peel effect occur.

Cause	Corrective Action
Powder output too high	Reduce powder output
Voltage too high	Reduce voltage
Objects too warm	Reduce the drying oven temperature and extend the cooling time
Coating time too long	Reduce coating duration
Unfavourable object geometry	Change object suspension or gun guidance

Layer thickness too thin

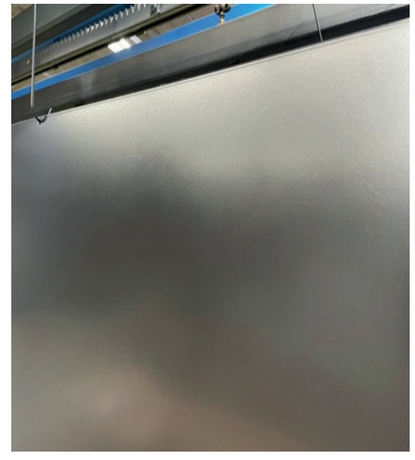
Characteristic:
The substrate is visible through the coating; the cured coating shows poor short-wave flow.

Cause	Corrective Action
Insufficient earthing	Check hangers and hooks
Insufficient powder charging	Check the high voltage and correct if necessary
Coating time too short	Extend coating time
Powder output too low	Increase powder output
Powder fluidisation less than ideal	Check fluidisation
Delivery hose too long	Shorten the hose, change the hose diameter or injector
Delivery hose blocked (foreign material)	Check the delivery hose; perform regular maintenance
Extraction too powerful	Reduce extraction or relocate the extraction system
Sintering in hose, injector or nozzles	Perform regular maintenance and optimise air balance
Lack of powder in the powder hopper	Top up powder and check the low-level probe
Particle-size distribution too fine	Continuously add fresh powder at shorter intervals
Too much insulation of the first coating	Reduce the high voltage, use a conductive solution or apply the second coat using a tribo process
Gun-to-object distance too great	Optimise distance
Use of Corona powder on Tribo system	Use tribo powder
Too much frictional charging in the hose	Change hose material, earth the hose a using a metal braid, for example

Fluctuating layer thickness

Characteristic:
Several phenomena may occur on the same object, including spray-back effect, substrate shining through, poor flow (short-wave and long-wave), orange-peel effect and pinholing.

Cause	Corrective Action
Pulsating powder feed	Check air flow, hose routing (kinking) and compressed-air stability, check fluidisation in the powder hopper
Incorrect gun arrangement (automatic coating)	Check the chain or lifting speed, optimise the sine curve of the automatic guns
Unfavourable object geometry (Faraday cage)	Precoat critical areas by hand, change suspension and/or gun arrangement
Objects with differing geometries	Change suspension
Insufficient mixing of fresh and recirculating powder	Optimise fresh powder metering
Trickling of the powder coating layer due to vibrations	Eliminate the source of vibration (conveyor, check chain tension), check earthing and charging



Poor fluidisation

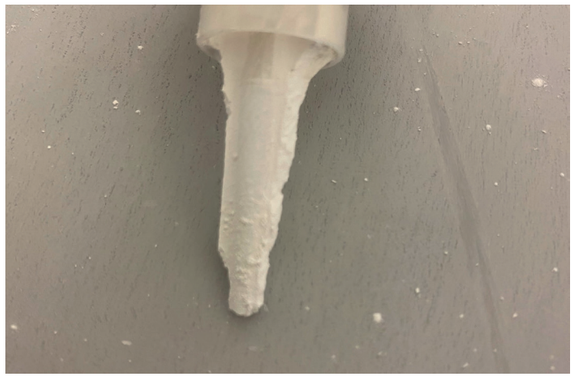
Characteristic:
Well-fluidised powder behaves like a lightly simmering liquid. Poor fluidisation can be recognised by volcano-like funnels in the powder hopper, pulsating delivery and an inhomogeneous powder cloud.

Cause	Corrective Action
Fluidisation air too low or too high	Increase or decrease the fluidisation air pressure
Fluidiser bottom clogged or defective	Clean or replace the fluidiser bottom
Too much overspray in recirculation	Increase proportion of fresh powder
Powder too fine	Contact the powder supplier
Powder is moist	Store powder according to supplier's instructions
Powder is highly compacted in the container	Sieve the powder, do not set the vibrator for continuous operation
Oil residues in compressed air	Check the oil separator
Temperature and/or humidity too high in the coating room	Reduce temperature and humidity levels

Sintering in the delivery hoses

Characteristic:
Powder-coating agglomerates can form in the hoses and are sporadically carried along by the conveying air. They become noticeable as “spitters” on the coated surface. After curing, these accumulations appear as raised areas on the surface.

Cause	Corrective Action
Air speed too high or too low	Adjust the air speed (approx. 15 m/s)
Hose routing not ideal	Check the hose routing for kinks (siphon effect)
Unsuitable hose material	Use a suitable material (not PVC)
Hose diameter incorrect	Match the powder output with the hose diameter
Oil residues in compressed air	Check the oil separator



Clumping in the container

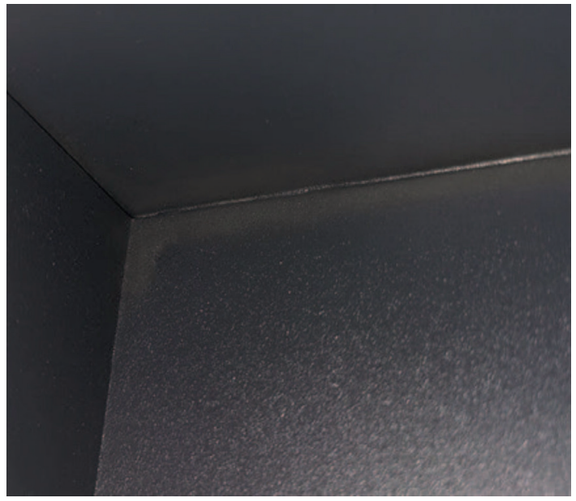
Characteristic:
Powder clumps in the container, ranging from loose agglomerates to hard solid masses.

Cause	Corrective Action
Incorrect storage	Store according to the powder supplier's instructions
Unfavourable transportation conditions	Check on receipt and contact the powder supplier if necessary
Vibration during powder discharge	Do not operate the vibration table continuously

Poor penetration into cavities

Characteristic:
Due to the Faraday cage effect, only minimal layer thickness can be achieved in corners and edges. In cases of poor penetration, the penetration depth is insufficient, while excessive layer thickness may occur on exposed surfaces.

Cause	Corrective Action
Unsuitable nozzle	Use a slot nozzle or a flat spray nozzle
Voltage not optimised	Reduce voltage
Powder output too high or too low	Optimise powder output
Insufficient object earthing	Check contacts, especially hangers and hooks
Faraday cage	Switch to Tribo application where possible
Particle-size distribution unsuitable	Contact the powder supplier
Gun-to-object distance not ideal	Optimise the gun-to-object distance



SURFACE DEFECTS

Orange-peel effect

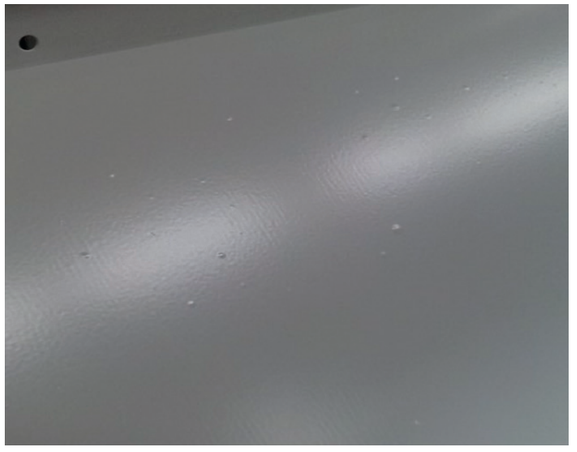
Characteristic:
Short-wave or long-wave surface imperfections in the cured coating, associated with poor flow.

Cause	Corrective Action
Spray-back effect	Reduce the voltage; increase the gun-to-object distance, use ion collection
Layer thickness too high or too low	Adjust the delivery and metering air
Heating curve too flat	Increase oven temperature
Unsuitable particle-size distribution	Consult the powder supplier
Powder coating out of date	Check the storage date and replace the powder material with fresh powder if necessary
Object surface unsuitable	Check surface roughness
Uneven object thickness (thin and thick areas)	Adjust oven temperature

Spitters on coated objects

Characteristic:
Spitters are powder accumulations that appear as bumps on the uncured powder surface. After curing, they remain visible as raised defects on the coated surface.

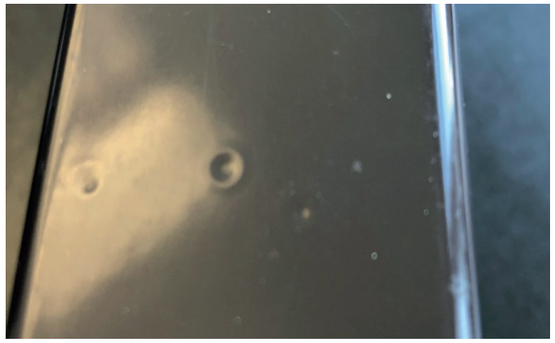
Cause	Corrective Action
Powder too fine (recovery)	Increase the proportion of fresh powder
Powder is moist	Use dry powder, allow powder from cold storage to acclimatise before use
Powder build-up on the deflector plate	Check the atomiser air setting
Powder falling from the hanger	Remove paint from the hanger to ensure proper earthing
Powder falling from the cabin roof	Shorten cleaning cycles
Poor fluidisation	See "Poor fluidisation"
Pulsating delivery	Check air flow, hose routing (kinking) and compressed-air stability
Hose routing not ideal	Shorten hoses, possibly reduce the hose diameter or implement structural measures
Unsuitable hose material	Use suitable hose material (PTFE, silicone, PU)
Deposits in the hose	See "Sintering in the delivery hoses"
Catch nozzle worn out	Replace catch nozzle
Too much fluctuation in the hopper level	Reduce minimum/maximum gap

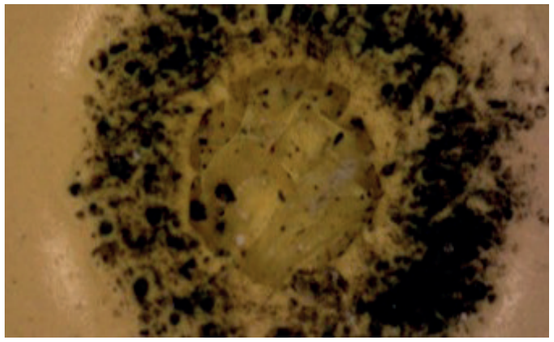


Craters and fish eyes

Characteristic:
Round, open defects in the cured coating, which may extend down to the substrate.

Cause	Corrective Action
Insufficient pretreatment (e.g. oil and grease residues)	Check the substrate for oil and grease residues, consult the chemical supplier
Chemical residues	Check pretreatment process, consult the chemical supplier
Oil in delivery and metering air	Check the filter of the cold dryer and upstream of the coating booth
Silicone from the surroundings, hand cream	Use silicone-free products and wear gloves
Incompatibility with other powder coatings (especially textured powders)	Perform thorough cleaning of the entire coating system.
Ambient air contaminated	Filter the feed air
Outgassing from the substrate	Heat-treat the object, use a degassing additive, check the steel quality
Different powder coating qualities in the curing oven	Avoid mixing different powder qualities, change procedures or implement structural measures
Application over wet paint	Check the suitability of the wet paint beforehand
Application over fillers	Check the suitability of the filler beforehand

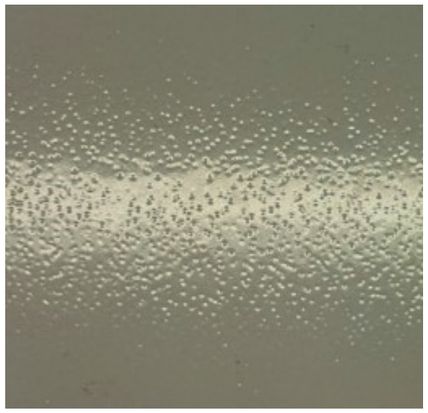




Pinholes

Characteristic:
Pinprick-like pores in the cured coating, which may extend down to the substrate.

Cause	Corrective Action
Layer thickness too high (especially with Primid powders)	Reduce the layer thickness and lower the curing temperature
Air inclusions	Adjust the heating curve and reduce the heating rate
Moisture content of the powder too high	Check storage conditions and avoid condensation when moving powder from cold storage to the warm coating environment
Outgassing from porous objects (hot-dip galvanised castings, excessive Si content of the steel)	Heat-treat the objects, use a degassing additive; check the steel quality
Incompatibility with other powder-coating qualities	Perform thorough cleaning of the coating system and consult the powder supplier



Inclusions and contamination

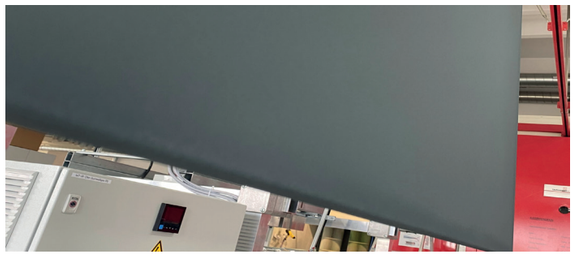
Characteristic:
Embedded foreign objects or powder particles of a different colour in the cured coating.

Cause	Corrective Action
Pre-reacted powder	Check using a new container, sieve if necessary; consult the powder supplier
Contamination from the delivery system, tears in the sieve	Clean the delivery system and check the sieve
Fibres, lint	Use suitable cleaning materials
Contamination from the ambient air	Filter the feed air, regularly clean the area around the coating booth, avoid draughts and grinding work in the immediate vicinity of the system
Insufficiently treated metal surfaces (welding beads, aluminium pressing pick-ups, metal chips)	Inspect the objects and improve surface preparation if necessary
Contamination during handling	Ensure containers are securely closed during storage and internal transportation
Excessive air speed and powder blow-off in the curing oven	Reduce the air feed, create a gelling zone, avoid processing differently coloured objects in the oven
Application of dust and powder particles to hot objects emerging from the oven	Avoid draughts and create a dust-free cooling zone
Entry of dirt where cabins are next to each other	If possible, avoid using compressed air for cleaning, as powder may be distributed into the environment. If necessary, implement structural measures

Picture framing

Characteristic:
Different appearance in flow and texture at the edges of an object, caused by increased layer thickness.

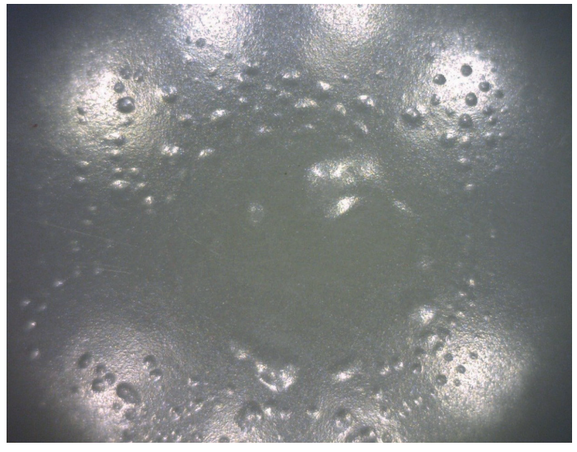
Cause	Corrective Action
Object-to-gun distance too great	Reduce the object-to-gun distance
Voltage too high	Adjust the voltage at the object, use a blanking plate if necessary
Delivery air too high	Adjust the delivery air



Blistering

Characteristic:
Elevations in the coating film caused by inclusions, resulting in poor adhesion to the substrate.

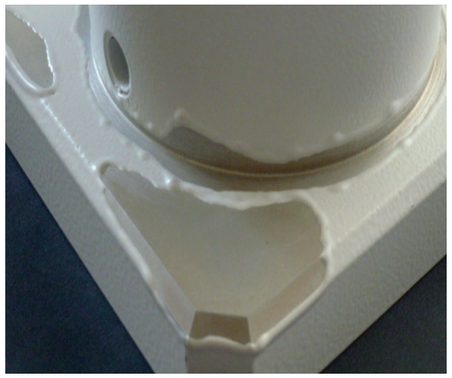
Cause	Corrective Action
Corrosion, oil and grease residues	Check and optimise pretreatment
Water adhering to the object	Check the drying oven and object suspension
Object geometry with cavities	Change the suspension, consider the object geometry, redesign the objects if necessary
Application over fillers	Check the suitability of the filler beforehand
Application over wet paint	Check the suitability of the wet paint beforehand
Wetting errors due to salt or chemical residues	Check pretreatment and consult the chemical supplier
Poor conversion coating	Ensure that pretreatment is carried out correctly



Wetting problems over large areas

Characteristic:
Large-area peeling of the cured coating surface and poor adhesion to the substrate, already visible during application.

Cause	Corrective Action
Pretreatment residues	Perform a final rinse with deionised water
Drying of pretreatment chemicals due to belt stoppage	Avoid stoppages, spray with water or steam
Carry-over of oil/grease in pretreatment	Check pretreatment processes and the oil separator
Oil, grease, release agent or drawing agent on the object surface	Check pretreatment and change it if necessary
Sweat from hands; dirty gloves	Do not touch pretreated objects with bare hands or with dirty gloves



Dripping

Characteristic:
Gelling powder coating running off the substrate in the form of drops.

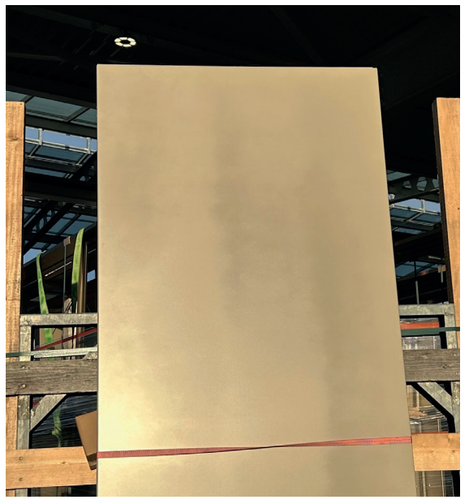
Cause	Corrective Action
Layer too thick	Reduce the layer thickness
Powder accumulations in internal edges due to trickling	Optimise system settings; check for blow-off effects, review the particle-size distribution and consult the powder supplier if necessary
Object temperature too high (drying oven or due to heat treatment)	Extend the cooling phase
Heating curve too steep	Reduce oven temperature
Powder coating not suitable	Consult the powder supplier

SURFACE DIFFERENCES IN THE POWDER COATING FILM

Clouding

Characteristic:
Non-uniform visual effects with metallic powders and uneven gloss levels when using dry-blend powders.

Cause	Corrective Action
Gun-to-object distance too small (blow-off effect)	Adjust the gun-to-object distance
Manual recoating	Precoat where possible
Uneven charging	Check the application process
Fluctuating layer thickness	Check and stabilise the layer thickness
Separation during recovery	Ensure continuous addition of fresh powder
Uneven powder delivery	Check the powder delivery system (fluidising hopper and compressed air)
Sine curve not ideal	Coordinate the chain speed and lift



Colour difference

Characteristic:
Gradual or abrupt changes in colour or visual effect compared to the start of coating or a master sample.

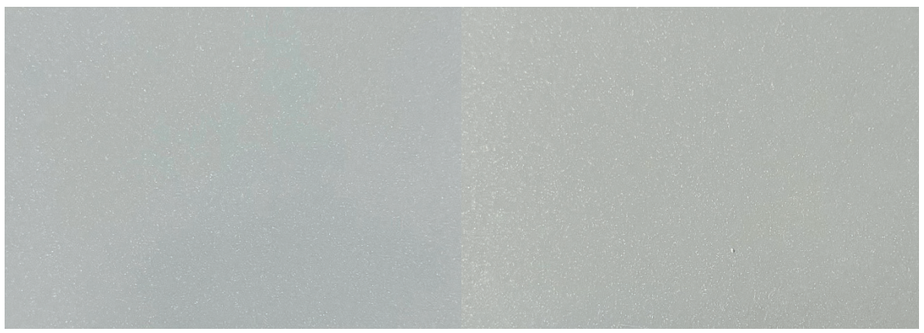
Cause	Corrective Action
Layer too thin	Increase the layer thickness
Strongly fluctuating layer thickness	Ensure even layer thickness
Different materials or surfaces (aluminium, steel, brass, glass, blasted, ground, chromated)	Use an identical surface for comparison
Insufficient coverage ability of the powder coating	Consult the powder supplier
Overcuring of the powder coating	Follow the powder supplier's specifications
Different curing conditions for identical objects	Follow the powder supplier's specifications
Different curing techniques (directly or indirectly heated oven, IR heat source, use of room air for the burner)	Use the same curing technique select suitable powder coatings, use only fresh air (not room air) for burners
Different wall thicknesses of the objects	Follow the powder supplier's specifications and adjust the process to the wall thickness
Various powder suppliers	Do not change the supplier for object-related orders
Excessive colour deviation from first coat when recoating	Avoid recoating over strongly varying colour tones
Metamerism: Colour differences due to different light sources	Do not change the supplier without prior sampling

All these sheets comply with RAL 9006

Yellowing, difference in gloss level, discolouration

Characteristic:
Differences in shade and/or gloss level compared to the master sample.

Cause	Corrective Action
Overcuring in the oven	Follow the powder supplier's specifications, do not cure thick- and thin-walled objects together, reduce the oven temperature immediately if the system is at a standstill
Directly heated gas ovens	Adjust the oven temperature for the powder coating and consult the powder supplier
Incompatibility with other powder coatings	Do not cure different powder qualities at the same time; consult the powder supplier
Excessive differences in layer thickness	Optimise the system parameters
Different gloss levels due to dry-blend powder application	Do not use both tribo and corona application for the same job
Solvent or oil in the oven	Do not use solvents or oil in the immediate vicinity of the oven



Sheet metal before yellowing

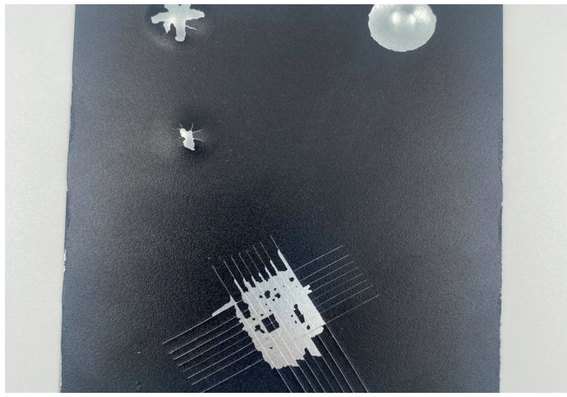
Sheet metal after yellowing

PROBLEMS WITH TECHNICAL PROPERTIES

Poor mechanical properties and chemical resistance

Characteristic:
The required mechanical and/or chemical properties of the powder coating are not achieved.

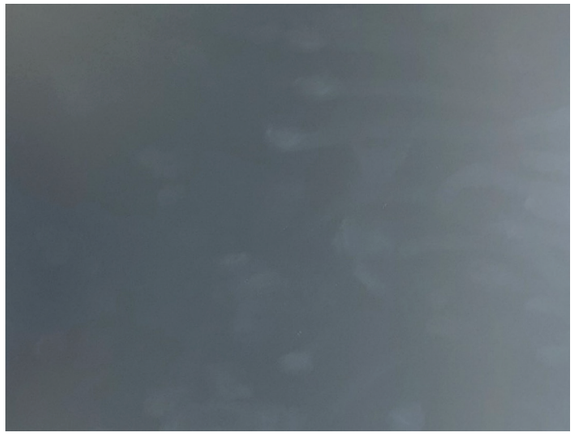
Cause	Corrective Action
Defective pretreatment (grease, oil, dust, release agent on the substrate)	Improve pretreatment and consult the chemical supplier
Inappropriate heating temperature or time	Follow the powder supplier's recommendations for curing
Incipient chalking with transparent overcoating due to UV exposure	Do not overcoat indoor-quality products with UV-resistant transparent powders. Use a fully UV-resistant coating system to ensure long-term performance and proper intercoat adhesion
Powder quality not suitable	Change the powder coating quality and consult the powder supplier



Soapy, greasy surface

Characteristic:
A hazy film on the powder-coated surface that can be wiped off.

Cause	Corrective Action
Curing temperature too low	Follow the powder supplier's recommendations for curing
Additives seeping out	Optimise the oven parameters and consult the powder supplier
Insufficient air balance in the oven	Optimise the air balance and consult the oven supplier
Directly heated gas oven	Consult the powder supplier, ensure the powder coating is suitable for directly heated gas ovens
Incompatibility of different powder coatings in the oven	Avoid simultaneous curing of different powder coating qualities in the oven and consult the powder supplier



Flaking of the cured powder-coating layer

Characteristic:
When subjected to mechanical stress, the powder coating detaches from the substrate due to insufficient adhesion.

Cause	Corrective Action
Insufficient crosslinking of the powder coating	Follow the powder supplier's specified curing conditions
Brittling of the powder coating (IR oven)	Follow the powder supplier's specified curing conditions
Excessive wall thickness	Follow the powder supplier's specified curing conditions
Insufficient pretreatment	Optimise pretreatment, consult chemical supplier
Laser-cut objects	Mechanical processing (grinding, brushing or sweeping)
No intercoat adhesion	Lightly abrade the first coat and check adhesion beforehand
Defective conversion coating	Optimise pretreatment, consult chemical supplier
Layer too thick	Optimise the system parameters

Insufficient abrasion resistance

Characteristic:
The powder coating shows insufficient resistance to abrasive wear.

Cause	Corrective Action
Insufficient crosslinking	Follow the powder supplier's specified curing conditions
Inadequate packaging	Select suitable protective packaging (foam, bubble wrap)
Powder coating is too soft or sensitive to scratching	Check the suitability of the powder beforehand and consult the powder coating supplier

APPLICATION OF METALLIC POWDERS

Metallic effect deviation from the master sample

Characteristic:
The metallic effect is too strong or too weak compared to the master sample or to objects coated at the start of the application.

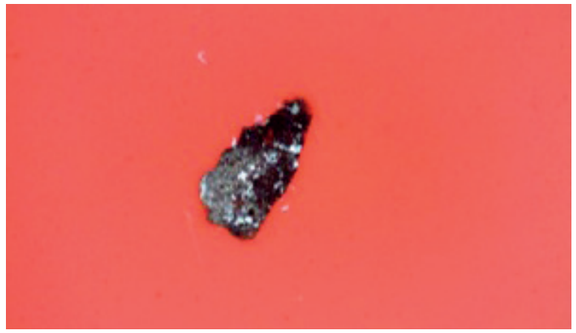
Cause	Corrective Action
Insufficient fresh-powder addition when processing with recirculation	Ensure continuous addition of fresh powder and continuously monitor colour during the coating process
Different application types (corona, tribo, with ion collection)	Coat object-related jobs using the same application type throughout
Difficult-to-coat objects in automatic mode	Anual recoating (respraying) if necessary
Object-related orders	Use powder from the same supplier and inform the customer about potential risks
Supply fluctuations	If possible, use the same powder batch for object-related orders
Separation during delivery from the container	Use a fluidising hopper with a vibrating table
Gun-to-object distance too large or too small	Keep the gun-to-object distance as even as possible

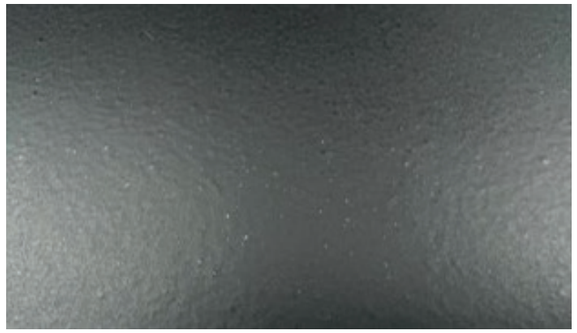
APPLICATION WITH RECOVERY

Contamination of the powder coating surface

Characteristic:
Foreign objects or powder particles of a different colour embedded in the powder coating film.

Cause	Corrective Action
Residues of powder or dirt from the previous coating in the system	Thoroughly clean the entire system
Sintering	Check hoses, injectors, guns, the cyclone, filters and sieves
Abrasion of the carriage discharge belt	Replace the carriage discharge belt
Final filter defective – blowing powder into the coating room	Repair or replace the final filter





POLYFLEX® Powder Coatings

Sampling options

A5 KABE Standard surface samples

A5 aluminium surface samples
(including product information)

- Delivered in a practical sample case, ideal for filing.
- The surface patterns are coated according to your specifications if required.

KABE powder coating sample

- We produce 1.5 kg of powder according to your requirements.
- Delivered in a 1.5 kg mini carton.
  (not valid for all items)

Request samples and technical information.

Powder coatings | Paints + plasters | Facade insulation | Industrial coatings

KARL BUBENHOFER AG | Hirschenstrasse 26 | 9201 Gossau SG, Switzerland
T +41 71 387 41 41 | pulver@kabe-farben.ch | kabe-farben.ch

KABE Powder Coatings Sp. z o.o. | ul. H. Sucharskiego | 77-100 Bytów, Poland
T +48 59 822 22 22 | info@kabe-powdercoatings.com | kabe-powdercoatings.com

KABE Pulverlack Deutschland GmbH | Sofienstrasse 36 | 76670 Graben-Neudorf, Germany
T +49 7255 99 161 | info@kabe-pulverlack.de | kabe-pulverlack.de

A company of the **KABE** SwissGroup