

Correctional procedures in the powder coating processes

Powder coatings offer very limited possibilities in altering the powder that is supplied. However, good routines and alertness will largely prevent problems from occurring.

In most cases, the powder will be custom-made for a specific use or a specific process. Even though powder and equipment can vary from one application to another, there are a number of common problem areas. The following are systematically presented with reference to possible causes and suggestions for their correction.

For the best possible result and a problem-free powder coating process it is vital that all instructions from both the suppliers of materials and the equipment be followed exactly.

Powder delivery

Phenomenon	Possible cause	Suggested solution
Powder spills out of the powder hopper	<p><i>Fluidization air pressure is too high</i></p> <p><i>Proportion of fine-grained particles is excessive</i></p>	<p>Reduce fluidization air pressure</p> <p>Reduce the proportion of recycled powder in relation to virgin powder in the powder hopper</p> <p>Discuss with the powder supplier the possibility of supplying powder with a lower proportion of fine-grained particles.</p>
The powder is not fluidized	<p><i>Insufficient air pressure</i></p> <p><i>Clogged membrane in the bottom of the powder hopper</i></p> <p><i>Powder packed down in the bottom of the hopper</i></p>	<p>Check the compressed air supply. Examine and if necessary, increase the pressure in the compressed air network</p> <p>Examine the condition of the supply lines.</p> <p>Empty the hopper and check if the membrane is clogged.</p> <p>Manually stir the powder in the hopper and increase the air pressure in order to start fluidization.</p>

Phenomenon	Possible cause	Suggested solution
<p>Poor fluidization</p> <p>After a while, only "eruptions" that blow air in certain places</p>	<p><i>Too little powder in the hopper</i></p> <p><i>Compacted or damp powder</i></p> <p><i>Clogged or damaged membrane</i></p>	<p>Add virgin powder so the hopper is approximately 2/3 full under fluidization</p> <p>Increase the air pressure and manually stir the powder in the hopper.</p> <p>Check the moisture in the compressed air (dew point <3°C)</p> <p>Empty the hopper and examine the membrane</p>
<p>Lumps of powder in the hopper</p>	<p><i>The powder has been stored too long or under unfavourable conditions (temperature/humidity)</i></p>	<p>Sift the powder through a 200-300µ sieve</p> <p>Powerful fluidization with clean, dry compressed air</p>
<p>Accumulation of powder in the hoses – powder delivery in bursts</p>	<p><i>Air velocity is too low in relation to the amount of powder</i></p> <p><i>Too much wear on the ejector plugs</i></p>	<p>If possible, increase supplemental air flow pressure on the ejector</p> <p>Change to hoses with a smaller diameter</p> <p>Install new ejector plugs</p> <p>Consider using ejector plugs made of another material</p>
<p>Dust from the spray booth – insufficient ventilation</p>	<p><i>Unnecessarily large openings in the booth</i></p> <p><i>Clogging of filters in the booth or of the final filter</i></p> <p><i>Amount of powder sprayed is too large</i></p>	<p>Close unused openings</p> <p>Adjust the entrance and exit to the size of the objects</p> <p>Clean and if needed, replace filters or filter cartridges</p> <p>If possible, increase the ventilation in the spray booth</p> <p>Reduce the number of spray guns or reduce the amount of powder per gun</p>

Phenomenon	Possible cause	Suggested solution
<p>Powder is not sufficiently charged</p> <p>Insufficient wrap-around – poor deposition efficiency</p>	<p><i>The high-voltage generator is not providing enough voltage to the spray gun's electrodes</i></p> <p><i>Poor earthing connection</i></p> <p><i>Too much powder per spray gun</i></p> <p><i>Proportion of fine-grained particles are too high</i></p> <p><i>Inappropriate type of powder</i></p>	<p>Ensure that cables and fuses are intact</p> <p>Ensure that the electrodes are in good condition</p> <p>Increase the generator voltage</p> <p>Ensure that the actual spray gun voltage is the same as that shown on the control panel</p> <p>Check the connection between the object and the conveyor and between the conveyor and the earth</p> <p>All contact points must be free of powder coating and other insulating materials</p> <p>Reduce the amount so that as much of the powder as possible that passes the spray gun is charged.</p> <p>Reduce the proportion of recycled powder in relation to virgin powder</p> <p>Check with the powder supplier on the possibility of supplying powder with a lower proportion of fine-grained particles</p> <p>Check with the powder supplier if the powder is appropriate for the specific use/powder application equipment</p>
<p>Insufficient penetration in corners and recesses</p>	<p><i>Air velocity in the spray gun is too high – the powder is blown off</i></p> <p><i>Incorrect distance between the spray gun and the object</i></p> <p><i>Amount of powder per spray gun is too small</i></p> <p><i>Poor earthing connection</i></p>	<p>Reduce the supplemental air flow</p> <p>Increase or reduce the distance between the spray gun and the object</p> <p>Increase the air pressure on the ejectors</p> <p>Check the connection between the object and the conveyor and between the conveyor and the earth.</p> <p>All contact points must be free of powder coating and other insulating materials</p>

Phenomenon	Possible cause	Suggested solution
	<p><i>Spray could is too wide</i></p> <p><i>Voltage is too high on the high voltage generator</i></p> <p><i>Air velocity is too high</i></p> <p><i>Incorrect spray gun adjustment</i></p> <p><i>Proportion of fine-grained particles are too high</i></p>	<p>Change to a smaller deflector or to a flat jet beam nozzle</p> <p>Reduce the voltage in order to even out the differences in coating thickness on interior and exterior corners</p> <p>Reduce the supplemental air flow pressure, and if necessary increase the distance between the spray gun and the object to prevent the powder from being blown off</p> <p>Adjust the spray guns so that the cloud of powder is directed as much as possible towards the most difficult areas of the object</p> <p>Reduce the amount of recycled powder by optimising the spraying process</p> <p>Check with the powder supplier on the possibility of supplying powder with a lower proportion of fine-grained particles</p>
<p>Difficult to build up sufficient film thickness</p> <p>The powder slides off</p>	<p><i>Not enough charging / charging effectiveness</i></p> <p><i>Poor earthing connection</i></p> <p><i>Air velocity is too high</i></p> <p><i>Adverse moisture in the work area</i></p>	<p>Ensure that cables, fuses and electrodes are working</p> <p>Increase the voltage from the generator Check the spray gun voltage</p> <p>Check the connection between the object and the conveyor and between the conveyor and the earth</p> <p>All contact points must be free of powder coating and other insulating materials</p> <p>Reduce the air pressure, and if necessary increase the distance between the spray gun and the object</p> <p>Avoid relative humidity below 30% and above 70% - the ideal range is 45-55%</p>

Phenomenon	Possible cause	Suggested solution
Back-ionisation/uneven powder layer	<p><i>Unnecessarily high voltage</i></p> <p><i>Insufficient distance between the spray gun and the object</i></p> <p><i>Poor earthing connection</i></p>	<p>Reduce the voltage</p> <p>Increase the distance</p> <p>Check the connection between the object and the earth</p>
Large variation in film thickness	<p><i>Incorrect spray gun adjustment</i></p> <p><i>Incorrect distance between spray gun and object</i></p> <p><i>Improperly adjusted conveyor and reciprocator speed</i></p> <p><i>Air flows in the spray booth that disturb the spray pattern</i></p> <p><i>Improper hanging technique</i></p> <p><i>Uneven powder delivery</i></p>	<p>Check the adjustment and ensure proper over-lapping</p> <p>Increase or reduce the distance</p> <p>Adjust the conveyor speed and/or the stroke and speed of the reciprocator</p> <p>Contact the equipment supplier</p> <p>Ensure that objects are as uniform as possible, correctly hung, and at the proper distance</p> <p>Ensure proper fluidisation and that the powder hopper is more than half full</p> <p>Examine the diameter and length of the hoses</p>
Spray problems after mixing in recycled powder	<p><i>Change the particle size distribution</i></p>	<p>Reduce the amount of recycled powder as much as possible through the hanging technique, spray gun adjustments, and charging effectiveness</p>
Spitting	<p><i>Accumulation of fine-grained powder in spray guns/delivery system</i></p>	<p>Reduce the amount of recycled powder as much as possible</p> <p>Reduce the time between each cleaning/blow through</p> <p>Check with the powder supplier on the possibility of supplying powder with a lower proportion of fine-grained particles</p>

Phenomenon	Possible cause	Suggested solution
Poor flow	<p><i>Film thickness is too low</i></p> <p><i>Heating up metal too slowly</i></p> <p><i>Spray gun voltage too high</i></p> <p><i>Inappropriate type of powder (reactivity is too high or powder particles are too coarse)</i></p>	<p>Measure the thickness with appropriate and calibrated equipment. Adjust the thickness by changing the air pressure on the ejectors</p> <p>Increase the oven temperature, or adjust the temperature profile. If possible, begin using IR heating in the entrance zone</p> <p>Reduce the voltage or increase the distance between the spray gun and the object</p> <p>Check with the powder supplier if the powder is appropriate for the specific use/powder application equipment</p>
Low gloss on a high gloss finish	<p><i>Contamination with another product that is not compatible</i></p> <p><i>Extreme temperature stress during heating</i></p>	<p>Thorough cleaning of the spray booth, delivery system and recycling system before adding virgin powder</p> <p>Reduce the effect in the IR-zone</p>
Pinholes in the finish	<p><i>Film thickness is too high</i></p> <p><i>Moisture</i></p>	<p>Reduce the film thickness</p> <p>Check if there is moisture in the compressed air or if drying after the pre-treatment is insufficient</p> <p>Check the degree of porosity in the substrate (cast iron)</p>
High gloss on a low gloss finish	<p><i>Insufficient curing</i></p>	<p>Increase the temperature and/or time in the oven</p>
Discolouration in the finish	<p><i>Contamination from powder used earlier in the equipment</i></p> <p><i>Contaminated virgin powder</i></p>	<p>Thorough cleaning of the spray booth, delivery system and recycling system before adding virgin powder</p> <p>Check with the powder supplier</p>

Phenomenon	Possible cause	Suggested solution
Specs in the coating finish	<p><i>Sintered powder in the spray guns loosens and adheres to the object</i></p> <p><i>The sieve in the recycling system is not functioning</i></p> <p><i>Impurities from the conveyor or hanging system fall down in the spray booth</i></p> <p><i>Impurities in the air in the work area are sucked into the spray booth</i></p>	<p>Stop and do a thorough cleaning Avoid using too much air pressure</p> <p>Inspect and repair/replace the sieve if necessary</p> <p>Routine cleaning of the conveyor and stripping the hooks</p> <p>Physical block-off of the area around the spray booth Good general cleaning Filtering and regulating the humidity in the work area</p>
Craters in the finish/surface	<p><i>Contamination with another product that is not compatible</i></p> <p><i>Grease on the metal surface after insufficient pre-treatment</i></p> <p><i>Moisture and/or oil in the compressed air</i></p>	<p>Stop and do a thorough cleaning before adding virgin powder</p> <p>Check and replenish the pre-treatment baths</p> <p>Examine the oil and water separators</p>
Porosity in the coating	<p><i>Moist substrate</i></p> <p><i>The powder quality is unsuitable for the specific substrate</i></p>	<p>Check the material after pre-treatment/drying</p> <p>Contact the powder supplier</p>
Incorrect or uneven colour	<p><i>Curing conditions exceed the specified range</i></p> <p><i>Variation in film thickness</i></p> <p><i>Varying substrate thickness</i></p> <p><i>Unsuitable type of powder</i></p>	<p>Refer to the product data sheet and make necessary adjustments</p> <p>Measure the thickness and make necessary adjustments</p> <p>Switch to polyester-based powder coatings</p> <p>Check with the powder supplier if the powder is appropriate for the specific use and type of oven</p>

Phenomenon	Possible cause	Suggested solution
Drop formation/sagging	<p><i>Film thickness is too high</i></p> <p><i>Type of coating is unsuitable for the specific use (flow too good)</i></p>	<p>Check the thickness and make necessary adjustments</p> <p>Contact the powder supplier</p>
Poor coverage of edges	<p><i>Sharp cutting edges on the metal</i></p> <p><i>Type of coating is unsuitable for the specific use (flow too good)</i></p>	<p>Contact the metal supplier/processor for changes</p> <p>Alternative hanging technique (sharp edges down)</p> <p>Contact the powder supplier</p>

Physical characteristics

Phenomenon	Possible cause	Suggested solution
Poor mechanical properties – impact strength/flexibility	<p><i>Insufficient curing</i></p> <p><i>Film thickness is too high</i></p> <p><i>Poor adhesion due to insufficient pre-treatment</i></p> <p><i>The nature of the powder coating</i></p>	<p>Take measurements of the metal's temperature profile</p> <p>Increase the temperature and/or time in the oven</p> <p>Check the thickness and reduce it by reducing the amount of powder or possibly increasing the conveyor speed</p> <p>Check and replenish the pre-treatment baths</p> <p>Check with the powder supplier</p>
Poor adhesion to the substrate	<p><i>Inadequate pre-treatment</i></p> <p><i>Insufficient curing</i></p>	<p>Check and replenish the pre-treatment baths</p> <p>Increase the temperature and/or time in the oven</p>

Phenomenon	Possible cause	Suggested solution
Poor corrosion resistance	<i>Inadequate pre-treatment</i>	Check and replenish the pre-treatment baths
	<i>Insufficient curing</i>	Increase the temperature and/or time in the oven
Poor chemical resistance	<i>Insufficient curing</i>	Increase the temperature and/or time in the oven
	<i>Improper choice of powder type</i>	Check with the powder supplier

Metallic powder coatings

Phenomenon	Possible cause	Suggested solution
No charging	<i>Short circuit in the spray gun</i>	Change to a special nozzle for metallic powder coatings
	<i>Improper spraying equipment</i>	Contact the powder supplier
Changes in the metallic effect over time	<i>Uneven consumption of base and metal pigment (dry mixed powder)</i>	Reduce the amount of recycled powder as much as possible by optimising the spraying process Frequent addition of virgin powder

Textured powder coatings

Phenomenon	Possible cause	Suggested solution
The substrate is visible under the texture	<i>Film thickness is too low</i>	Increase the thickness
Uneven texture	<i>Uneven film thickness</i>	Optimise the spraying process for the most even thickness possible
Variation in texture over time	<i>Variation in particle size distribution</i>	Reduce the amount of recycled powder as much as possible by optimising the spraying effectiveness

Recoating

Phenomenon	Possible cause	Suggested solution
Poor flow	<i>The first layer insulates thus limiting the earthing connection</i>	Reduce the spray gun voltage to 30-40 kV
Poor adhesion between layers	<i>Impurities on the surface of the first layer</i> <i>The powder coating is unsuitable for respraying</i>	Ensure thorough grease removal and rinsing Contact the powder supplier

Oven problems

Phenomenon	Possible cause	Suggested solution
Smoke/odour from the curing process	<i>Dry powder is blown off and comes into contact with the heating elements</i> <i>Overheating of the powder coat</i>	Reduce air speed in the oven's entrance zone. Check damper and fans to ensure that the oven is properly aired out. Take measurements of the metals temperature profile and reduce the temperature if necessary Check the effect and distance between lamps and materials in the IR zone, if one exists