



*Print Media Academy*

**HEIDELBERG**

## Profi Tip Coating, Drying and Powdering

# Foreword

**DEAR READER,**

This issue of Profi Tip is all about coating, drying and powdering. You'll learn about the advantages and disadvantages of oil-based varnishes and dispersion coatings as well as best-suited applications for two-roller systems and chamber doctor blade systems. We'll explain what kinds of defects can come up with dispersion coatings and how you can correct these. Further topics include infrared dryers and coating dryers, gloss measurement and the measurement of pile temperature. In addition, we will introduce you to the various spray powders and give you tips on how to choose the right type of powder and reduce the amount used. Thank you for your interest!

Sincerely yours,  
the Team of the Print Media Academy



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# Oil-based Varnish

The composition of oil-based varnishes is essentially the same as that of offset inks (75 % solid substance content as well as drying through penetration and oxidation). Since these varnishes are intended to create a highly transparent film with little coloring, all materials used have to be of premium quality. The varnishes can be processed full-surface without dampening (place a format sheet under the blanket) in the case of spot coating, on the other hand, a conventional offset printing plate with dampening is needed.

## **ADVANTAGES**

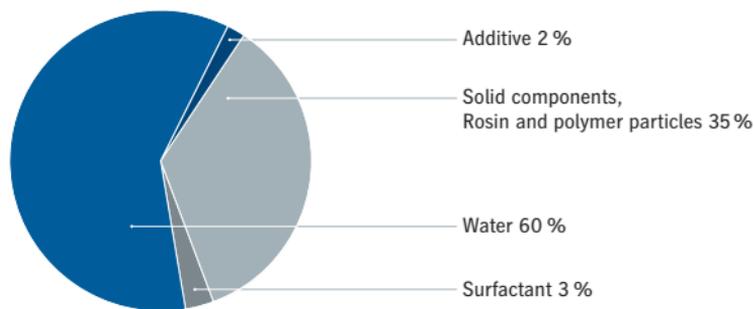
- Simple processing as with offset inks
- Good absorption of varnish
- Open areas easy to achieve with offset plates
- Good moisture protection
- No solvent emissions
- Flexible varnish film layer (no problem with creases and folds)

## **DISADVANTAGES**

- Low layer thickness
- Danger of yellowing
- Slow drying
- High amounts of spray powder needed
- Low pile height
- Possible influence on smell and taste with food packages

# Dispersion Coating

There are dispersion coatings without pigments (matt, finishing varnishes, gloss or high gloss coatings) and with pigments (silver and gold coating or Iriodin). Various polymer dispersions, or so-called modified acrylates, make up the base. Further components are water-soluble rosins, water as a solvent and diverse additives which significantly influence various characteristics like surface tension, wettability and abrasion resistance. Unlike oil-based varnish which dries via oxidation, in the case of dispersion coating, the drying process takes place completely physically: Through penetration and the evaporation water content, the polymer particles move closer together. The emulsion/polymer particles melt together and build a film.



## **DISPERSION COATING**

### **ADVANTAGES**

- Very fast film formation
- Utilization of full pile height
- Reduced spray powdering
- Good abrasion resistance
- Dry coating film odor-free
- Fast processing with corresponding machine configuration
- No effect on smell or taste of food
- No yellowing
- Good durability when deep-frozen – i.e. for frozen packaging

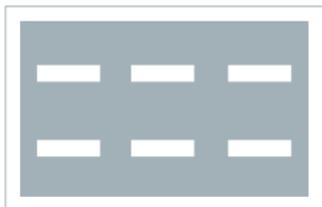
### **DISADVANTAGES**

- Dry coating is difficult to remove
- With printing stock under 90 gsm, problems with dimensional stability can occur
- For spot coatings, either expensive coating plates are used, or blankets have to be cut out manually
- The necessary amount of coating is hard to control

# Spot Coatings and Text

## BLANKETS

- Blankets are used for full-surface coating and coating with simple open areas (manually cut).
- The blanket used should be compressible but not too soft.
- Underlays have to be matched to the printing stock. While smooth printing stock can be processed with harder underlays, rough printing stock needs softer underlays.
- In order to create coating-free areas (adhesive straps), blankets can be manually cut and stripped. There are also special coating blankets where the upper layer is easy to pull off.

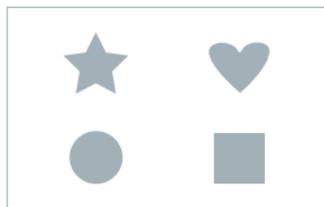


Left: full-surface coating

Right: manually cut blanket for simple open areas

## COATING PLATES

- Depending on standards for quality, coating plates are used either as flexible printing plates or metal plates.
- The choice of underlays for the coating plate (hard/soft) is decisive for the print quality.



Coating plates are used for intensive spot coatings and text

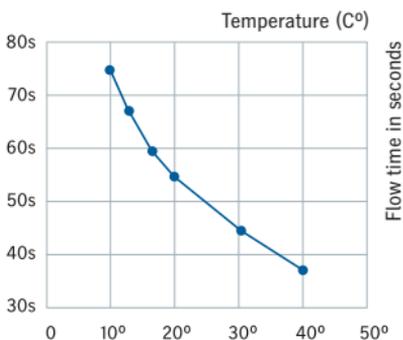
# Determination of Viscosity in Dispersion Coatings

The measurement of flow time with a flowcup is considered to be the standard test method to determine the viscosity of dispersion coatings because of its simple execution. The coating should always be mixed well before measurement.

Usually the DIN cup DIN 53 211-4 (3.4 ounces with a 0.16 inch opening [100 ml with a 4 mm opening]) is used for measurement. Recently, this standard was replaced with the international norm DIN EN ISO 2431.

Manufacturer information on the viscosity of the coating is usually based on a temperature of 68 °F (20 °C). The measurement is completed when the thread of liquid separates. As a general rule, the higher the viscosity, the thicker the coating!

## **MAKE SURE TO FOLLOW THE DATA SHEET WHEN TESTING!**



During measurement with the flowcup, make sure to pay attention to the temperature!



Comparison of Viscosities  
(Flow time in seconds)

Water-based coating	approx. 35 sec.
Metallic coating	approx. 45-50 sec.
UV coating	approx. 45-55 sec.

# Tips on Storing and Processing Dispersion Coatings

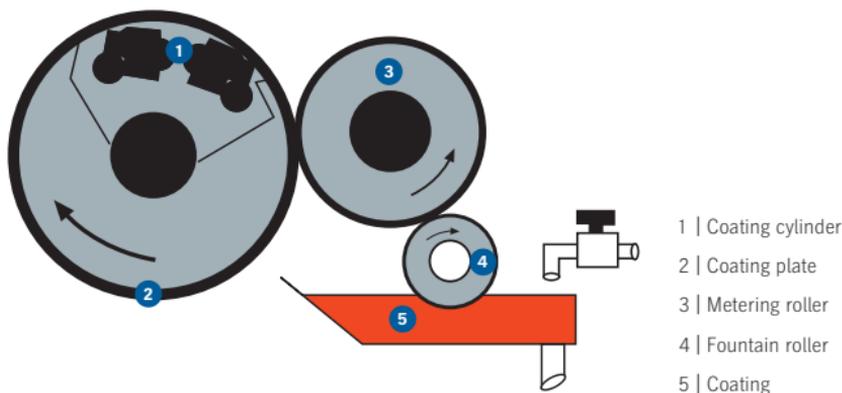
- Water-based coating should be stored at room temperature.
- Avoid storage temperatures of more than 104 °F (40 °C) or less than 59 °F (15 °C), in order to prevent changes in viscosity.
- Always mix the coating well and adjust the temperature if necessary so that it reaches its initial viscosity again.
- Dispersion coatings may only be stored for a limited amount of time – approx. 6 months. Effect and blister coatings may only be stored for 3 months.
- In the case of full-surface coating with a blanket, the coating application should by no means extend beyond the edges of the printing stock. For this reason, a format sheet at the edges at least 0.078 inches (2mm) smaller than the printing stock should be placed under the blanket.
- Set coating application to minimal compression.
- The majority of water-based coatings are alkalescent. The printing inks to be coated therefore need to be insensitive to alkaline materials.

# Coating Units

## TWO-ROLLER SYSTEM

In the two-roller system (see illustration below), a fountain roller scoops the coating out of an open coating pan and passes this on to the metering roller. The amount of coating supply is dependent on the preset revolution speed of the fountain roller. The level of coating in the open coating pan is monitored by an ultrasonic sensor. An electromechanical diaphragm pump ensures a continuous flow of coating. The amount applied is around 3 to 6 gsm wet. The exact amount applied can only be determined by weighing (scale). The two-roller system is suitable for surface and spot coatings. Compared to the chamber doctor blade system, the application of coating is more uneven. The application of coating is dependent on speed and is controlled by a coating characteristics curve.

**MAKE SURE TO ADJUST THE CHARACTERISTICS CURVE TO THE COATING USED!**

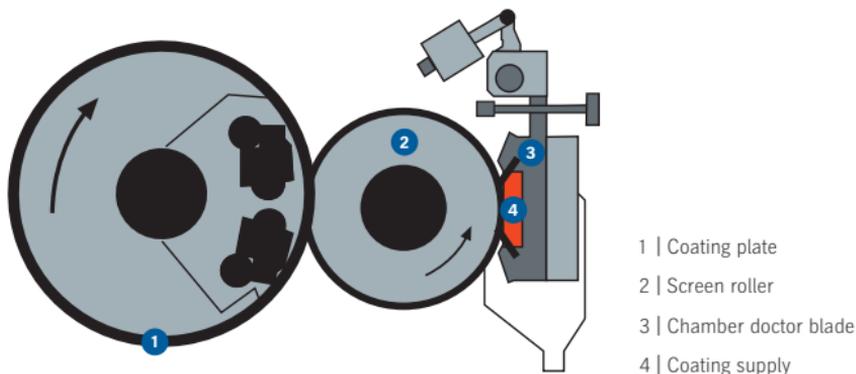


## CHAMBERDOCTOR BLADE SYSTEM

The chamber doctor blade consists of two doctor blades, which, together with the frame, build a closed chamber in which the coating is in constant circulation. A laser-engraved, ceramic-coated screen roller is responsible for metering. The amount of coating can be altered with exchangeable screen rollers with differing scoop volumes. The screen rollers ensure a defined and constant applied quantity as well as an even, smooth-coating application.

The chamber doctor blade system is suitable for matt, gloss, blister, UV, gold and silver coatings and other effect coatings such as pearly luster coating (Iridin) as well as for text and intricate designs.

For consistent results with a defined amount of coating, the screen roller needs to be cleaned thoroughly with water. In addition, a deep cleaning as well as an ultrasonic bath should also be carried out regularly.



# Problems with Dispersion Coating

## **PROBLEM WITH WETTABILITY**

In the case of a problem with wettability, the coating rolls off the surface instead of forming a complete film. This happens when the surface tension of the coating is higher than that of the ink. A higher surface tension causes the coating to contract and forms drops or mounds.

### **REMEDY**

- Add surfactant (follow dosage exactly)
- Use other coating
- Ask coating manufacturer

## **FOAMING**

Strong pumping along with the air intake produces a foam which can cause uneven and teardrop-formed defects in the coating application.

### **REMEDY**

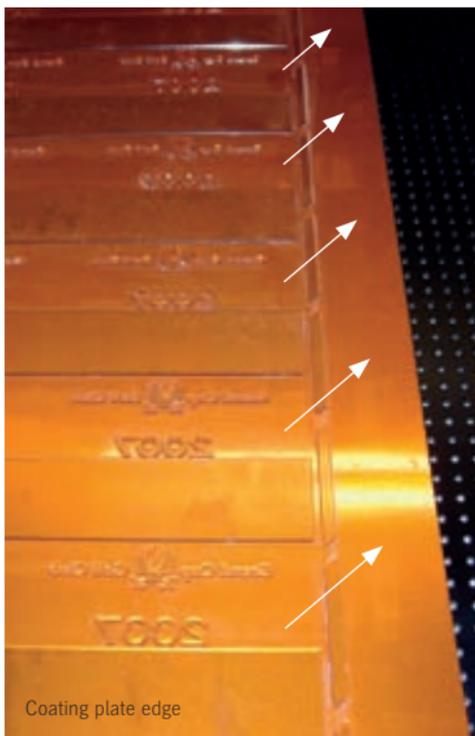
- Set coating pump so that no air gets sucked in and mixed in. Position the coating suction deep under the foam. Set the return flow equally “deep” so that little or no foam is produced.
- Reduce rotation speed
- Add defoamer (follow dose exactly)

## REGISTER PROBLEM WITH SPOT COATING

A register problem occurs when the coating form cannot be adjusted to the print or the register fluctuates.

### REMEDY

- Set mounting height and processing for the right printing length.
- In coating plate manufacture, mount guiding ridges with overlapping breaks. The bars should be secured in such a way that the air between the printing sheet and coating plate can escape to the sides at the gaps (see illustration).
- Guiding ridges start at the beginning of the plate as a support for the coating application rollers and end after the print.



Coating plate edge

The air between the bars should be able to escape to the back. The diagonal is therefore essential.

- Preset for kissprint to avoid unnecessary deformation of printing stock.
- Set tensioning rails to correct basic setting.
- Check dryer settings (temperature, air settings)
- Adjust coating amount

Coating plates are thicker than normal offset plates. This is why they also have to be exposed in a special drum-type imagesetter. If there's no drum-type imagesetter available, the master copy should be optically altered accordingly.

#### **SMALLER CORRECTIONS**

Smaller corrections can be made by changing the underlays under the coating plate: If you decrease the strength of the underlays, the coating form's printed impression becomes longer. If you increase the strength of the underlays on the other hand, the coating form's printed impression is shortened.

## **CRACKING**

Cracking refers to the formation of cracks in the coating film. These occur when the coating dries faster than the ink (“air shock”). The appearance is then comparable to an old oil painting. The cracks first originate in areas with very high ink concentration. Cracking often only arises during sheet removal and isn’t visible in the pile.

For inspection, take five freshly printed sheets, allow to lie for 1 to 2 minutes and then assess.

## **REMEDY**

- Check viscosity of coating
- Reduce drying temperature
- Increase printing speed
- Add retarder to the coating
- Use another coating



### **ORANGE PEEL EFFECT**

In the case of an inhomogeneous coating surface, coating flaws resembling the surface of an orange peel can occur.

#### **REMEDY**

- Reduce speed
- Reduce amount of coating
- Adjust viscosity correctly
- Choose another printing stock

### **NOT ENOUGH GLOSS**

Using gloss coating in finishing produces a much more noticeable gloss effect.

#### **REMEDY**

- Choose a printing stock with a closed, smooth surface (gloss coated)
- Use right gloss coating with correct amount of coating.
- Coat wet on dry. Wait at least 48 hours before starting the second pass.
- In case of loss of gloss after drying, use fast, quickly absorbed and more intense inks.

### **POOR DRYING**

Coating should be dry to the touch after 10 to 15 seconds.

#### **REMEDY**

- Improve removal of process air, avoid “washhouse effect”
- Stir coating and test its viscosity
- Reduce amount of coating
- Check temperature at infrared dryer and increase if necessary.  
Observe preheating of dryer
- Reduce machine speed

### **INK BUILDUP ON THE COATING FORM**

The ink penetrates through the coating onto the coating form, builds up and leads to flawed coating application.

#### **REMEDY**

- Reduce speed
- Increase coating amount
- Use suitable coating plate underlays
- Optimize positioning of coating rollers to coating form
- Reduce print supply
- Use alternative coating

### **INK BUILDUP ON COATING AND FOUNTAIN ROLLERS**

Caution: Screen rollers are unusable after ink application (deep cleaning necessary)

#### **REMEDY**

- Use appropriate screen roller (pay attention to interplay of coating quantity, screen rollers and coating)
- Check coating pump, clean or possibly exchange diaphragm
- Clean coating roller, fountain roller and coating blanket before new start

### **CRUSHED EDGES**

Occurs from coating or ink accumulation on the borders of the print image.

#### **REMEDY**

- Monitor and reduce, if necessary, mounting height between metering roller and coating plate as well as between coating plate and printing stock
- Use soft underlays under the coating plate (blanket or cut coating underlay blanket)
- Check viscosity
- Reduce amount of coating



Guiding ridges on the coating plate support the coating application rollers and prevent contact between the printing sheet and the coating plate.

### **SMEARING DUE TO CONTACT**

If sheet guidance is lacking, the sheet may come into contact with the deeper lying surfaces of the coating plate and transfer ink. The built up ink then transfers itself uncontrolled onto the following sheets.

### **REMEDY**

- Place guiding ridges on the coating plate in the bleed
- If possible, stick assisting ridges on the coating plate (pay attention to suitable material and strength)

## **BLOCKING**

Blocking is when the coated sheets in the pile stick together.

### **REMEDY**

- Reduce amount of coating
- Use suitable powder in correct dosage
- Optimize pile temperature according to material and speed
- Air pile after printing
- Use fast drying coating not inclined to blocking when wet
- Use fast penetrating, intense printing inks
- Do not place printed pile near heating units
- Air printed pile

## **SQUIRTING**

Drops of coating on the printing sheet can cause them to stick together.

### **REMEDY**

- Check settings on coating unit and correct if necessary
- Align metering roller and fountain roller centrally to one another
- Format sheet has to be smaller than the used printing stock
- Reduce speed
- Clean dirty coating unit thoroughly

### **STREAKS IN MATTE COATING**

Streaks often develop early on at the contact point between fountain roller and metering roller and are transferred onto the print.

#### **REMEDY**

- Mix matte coating with silk-matte coating
- Stir coating well
- Do not dip suction tube too deep in the coating tank
- Place reverse flow deep down in order to keep the coating on the bottom in motion
- Use an anilox roller with a chamber doctor blade system
- Reduce amount of coating applied if necessary
- In the case of two-roller systems, reduce viscosity

### **PAPER DISTORTION**

Because of the high percentage of water in the coating, paper distortion can occur, particularly in printing stock with low grammages and especially during perfecting.

#### **REMEDY**

- Reduce amount of coating
- Use suitable coating (“B+W coating”)
- Choose appropriate printing stock thickness

# Drying Systems

## INFRARED DRYER

This drying system heats the applied printing ink and printing stock with the energy from infrared radiation. The thermal effect accelerates the physical and chemical processes in drying the ink. The lower viscosity of the printing ink oils leads to a faster penetration. In addition, the warm pile of paper promotes oxidation. Low percentages of dampening solution in the applied ink layer further accelerates oxidation. The short-wave radiation of the infrared dryer penetrates predominantly into the paper, while the mid-wave radiation warms the air above the ink layer.



Infrared heater  
metalized with gold

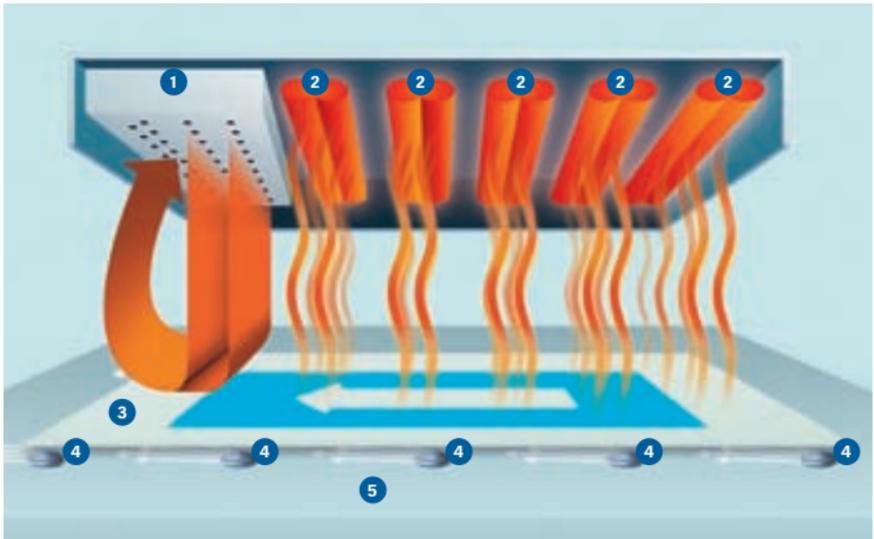
Properly chosen infrared heaters (original Heidelberg service parts) target the printing ink with heat and simultaneously protect paper and machine. Wave length, power and gold coating are optimally coordinated. The minimum lifetime of the heater is 5,000 hours.

When dealing with IR heaters, it is advisable to always wear clean gloves, because hand oils and sweat burn into the quartz tubes and shorten their lifespan. Regularly clean heaters and reflectors carefully with a vacuum cleaner. Only the front side of the heater may be cleaned with a soft, lint-free cloth soaked in alcohol. The back of the heater, on the other hand, is metalized with gold and may under no circumstances be cleaned with alcohol!

## COATING DRYER

In addition to the infrared heaters, hot air jets are integrated into the coating dryers. Hot, dry air is supplied and the processed air saturated with water is carried away. In order to achieve a secure removal of the water vapor, more air is always extracted than supplied by the dryer.

The polymer particles distributed finely in the solvent move continuously closer together because of water removal during drying. They are deposited on top of one another and build a hard polymer film when thoroughly dried. This is termed “coating.”



Schematic Illustration

1: Hot air system; 2: Infrared heater; 3: Printing sheet;

4: Air jets for sheet guide without contact; 5: Sheet guide plate

# Measurement of the Pile Temperature with a Hygrometer Probe



The temperature read from the hygrometer probe can deviate up to 50 °F (10 °C) downward of the pile's surface temperature (IR delivery sensor).

At ideal climate conditions in the pressroom, the ground rule is: In the case of paper, the temperature of the pile at delivery should be about 14 to 18 °F (8 to 10 °C) over the temperature of the feeder pile. In the case of cardboard, it should be about 18 to 27 °F (10 to 15 °C) over it.

If the correct pile temperature is exceeded, the emitted heat in the pile makes the inks soft again. When this occurs, there is a danger of set-off!

In the case of double-sided coating, reduce the temperature in both passes in order to prevent paper distortion and the coating layer on the back from becoming soft.

The ideal pile temperature can be most easily determined by tests. The test should be carried out together with an application engineer. The right pile temperature is dependent on many factors: coating characteristics, printing ink, absorbency of the printing stock, machine speed, drying path and delivery type, and control of discharged air.

# Gloss Measurement

- The gloss is always dependent on the printing stock and coating.
- If measurements are compared, it is necessary to pay attention to the measurement angle.
- A gloss measurement with a measurement angle of 60° is generally customary.
- Values range from 0 to 100 gloss points
- If gloss measurement doesn't always occur at the same time after printing, later measurements experience gloss point loss.
- 70 gloss points is a good result for a high-gloss coating wet-on-wet
- Under ideal conditions, 80 gloss points can also be achieved with the appropriate coating. (When using UV coating it is easy to achieve 95 gloss points)



A gloss measurement device enables an objective assessment of the gloss effect possible.

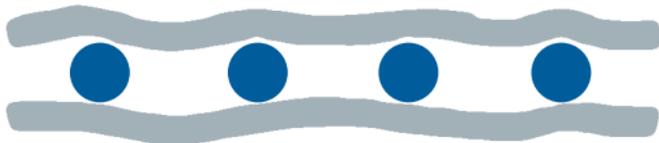
# Spray Powder

The job of spray powder is to create a separation distance between the freshly printed sheets. This separation effect prevents set-off in the pile and improves the drying process with oxygen supply.

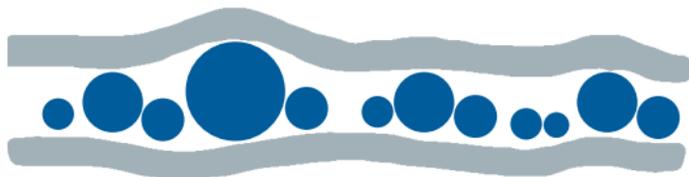
A fundamental sign of quality in spray powders is their particle size. In order to achieve an even spacing with small amounts of powder, primarily identical particle sizes are necessary. When the particle size in the powder is even, each individual powder particle gets used and unnecessary dust formation in the delivery is reduced. Due to the effects of drying and condensation, the powder can collect in various spots of the delivery. This can cause clumps of powder (agglomerates) which lead to visible spots on the printed sheet when they fall down.

It is therefore advisable to only use powders classified by the Institution for Statutory Accident Insurance and Prevention (<http://www.bgdp.de/> Download Leaflet Powder).

Only the use of well-sorted powder provides an even separation between the printed sheet, minimal powder consumption and low dust formation.



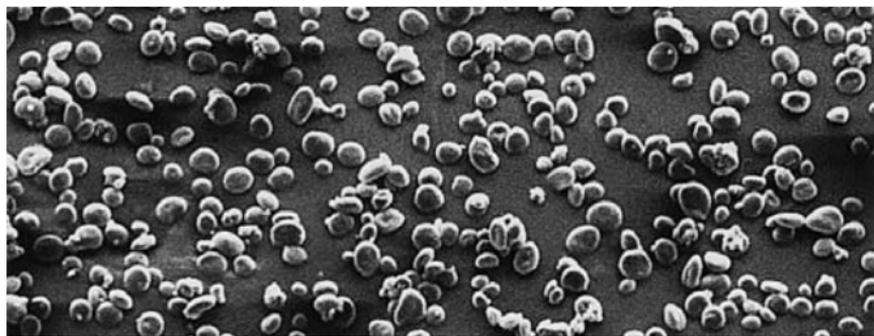
Well-sorted powder (ideal case)



Poorly sorted powders

#### **TIPS FOR CHOOSING THE RIGHT POWDER**

- Uncoated papers are more absorbent than coated. This means they also need less powder. Make sure to use a printing ink suitable to the printing stock.
- The coarser the printing stock is, the larger the size of the powder particles should be.
- The more ink printed on top of one another, the more powder is needed.
- In the case of printing stocks with different surface finishes (front and back side), the rough side is decisive. The size of powder particles should be chosen according to this.
- Powder type and particles must be chosen according to the printed material's later application (food packaging, perfume packaging, etc.) as well as the following work steps (coating, laminating, hot foil embossing).
- Heavy powder types (calcium carbonate) can be applied to the sheets more easily and more targeted than lighter ones (starch).



Source: ksl-staubtechnik

### **SPRAY POWDER FROM NATURAL STARCHES**

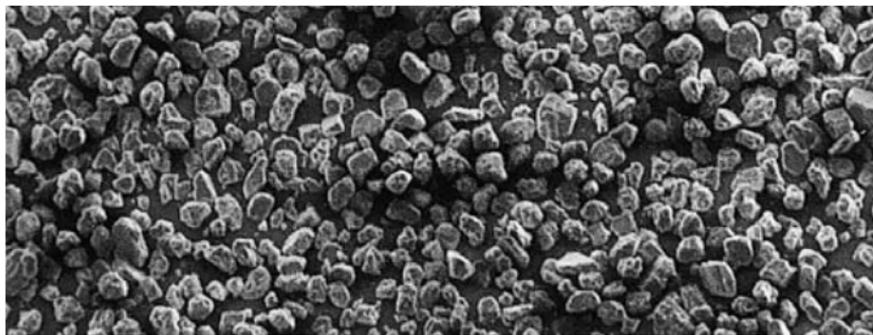
These powders are made from potato, corn or rice starch, among others. They are available in hydrophilic or hydrophobic versions.

#### **ADVANTAGES**

- Plant-based powder is spherical and soft in structure. Because of its advantageous flow behavior, it is very good to work with.
- Starch powders can be universally used

#### **DISADVANTAGES**

- Electrostatic charge possible



Source: ksl-staubtechnik

### **SPRAY POWDER FROM CALCIUM CARBONATE**

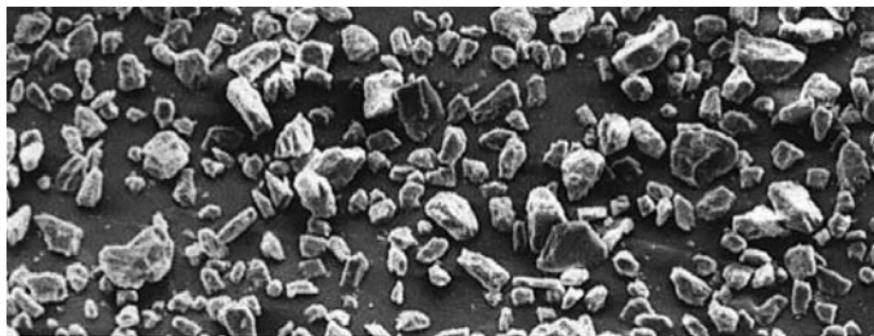
This is an inorganic mineral product as present in nature.

#### **ADVANTAGES**

- The high specific weight is particularly low-dust forming and therefore easy and economical to use.
- Calcium carbonate is water-insoluble and not sensitive to moisture or electrostatic charge.

#### **DISADVANTAGES**

- Calcium carbonate's crystalline structure can lead to scouring effects on the printing sheet.
- Calcium carbonate can reduce the printing plate's lifetime (with many machine passes).



Source: ksl-staubtechnik

### **SPRAY POWDER WITH SUGAR BASE**

These kinds of powders are special among spray powders. It is a dry, water-soluble spray agent with crystalline structure and soft particles.

#### **ADVANTAGES**

- Usually powders from sugar are used in successive print processes. The powder only leaves a very small amount of build-up on the blanket, is solubilized and lands in the dampening solution circulation.

#### **DISADVANTAGES**

- Because of its sensitivity to water, it cannot be used with an IR dryer.
- High maintenance of powder device because of deposits and clogging in the device.

### SPRAY POWDERS FOR PRINTING WITH DISPERSION COATINGS

The spray powder used for printing with dispersion coatings is surface-treated (coated) and is thus water-repellant (hydrophobic). Water-repellant powders are particularly advantageous for inline coating. This powder is also especially well-suited for sensitive materials, since it has a very low scouring tendency.

A simple test with powder in a water glass shows its suitability for printing with dispersion coatings.



Left: Hydrophilic  
(not suitable for inline  
coating)

Right: Hydrophobic  
(suitable for inline  
coating)

#### **DISADVANTAGES**

- Because of surface-treatment, this powder tends to produce more dust in the delivery area.
- In the case of later finishing (coating, laminating), higher dosages can cause repellent reactions and wettability problems.
- Higher maintenance of powder device because of deposits and clogging in spray nozzles
- Tendency towards electrostatic charge

## Recommendations for Use of Right Power Types

Powder type	Multiple runs	Single run	Subsequent jobs such as coating or laminating	Inline processing (UV coating)	Inline processing (Water-based coating)	IR Dryer Usage
Calcium carbonate	X	X	X	X	—	X
Calcium carbonate treated	X	X	—	X	—	X
Starch powder	X	X	X	X	—	X
Starch powder water-repellant	—	X	—	X	X	X
From sugar	X	—	—	—	—	—

## Help for Choosing Particle Sizes

Printing Stock	15 µm	20 µm	30 µm	45 µm
Calendered, machine coated, specially coated and one-sided coated papers and paperboards (chrome papers)	to 120 g/m <sup>2</sup>	120 to 170 g/m <sup>2</sup>	170 to 200 g/m <sup>2</sup>	—
Original art print and cast-coated papers and paperboards	to 150 g/m <sup>2</sup>	150 to 250 g/m <sup>2</sup>	250 to 400 g/m <sup>2</sup>	over 400 g/m <sup>2</sup>
Smooth paperboards, for ex. ivory board and imitation Bristol	—	150 to 200 g/m <sup>2</sup>	200 to 300 g/m <sup>2</sup>	300 to 600 g/m <sup>2</sup>
Rough or embossed paperboards	—	—	150 to 250 g/m <sup>2</sup>	250 to 600 g/m <sup>2</sup>

This table is a recommendation for choosing the right particle size. Legal claims may not be made from it.



#### **TIPS FOR REDUCING POWDER AMOUNTS**

- Use high-quality powder (minimal percentage of particulate matter, defined particle size)
- Use suitable particle size
- Choose largest possible particle size of powder
- Choose “heaviest” type of powder possible (calcium carbonate)
- Regular maintenance and ideal setting of powder device

# Previously published issues from the Profi Tip series:



Dampening  
Solutions in  
Offset Printing

*Feuchtmittel im  
Offsetdruck*



Problem Cases  
in the Pressroom

*Problemfälle  
im Drucksaal*



Rollers in  
Inking and  
Dampening  
Systems

*Walzen in Farb-  
und Feuchtwerk*



Coating, Drying  
and Powdering

*Lackieren,  
Trocknen und  
Pudern*

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