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**Coating Process
Optimization of
Automotive Components**

Andor Bariska

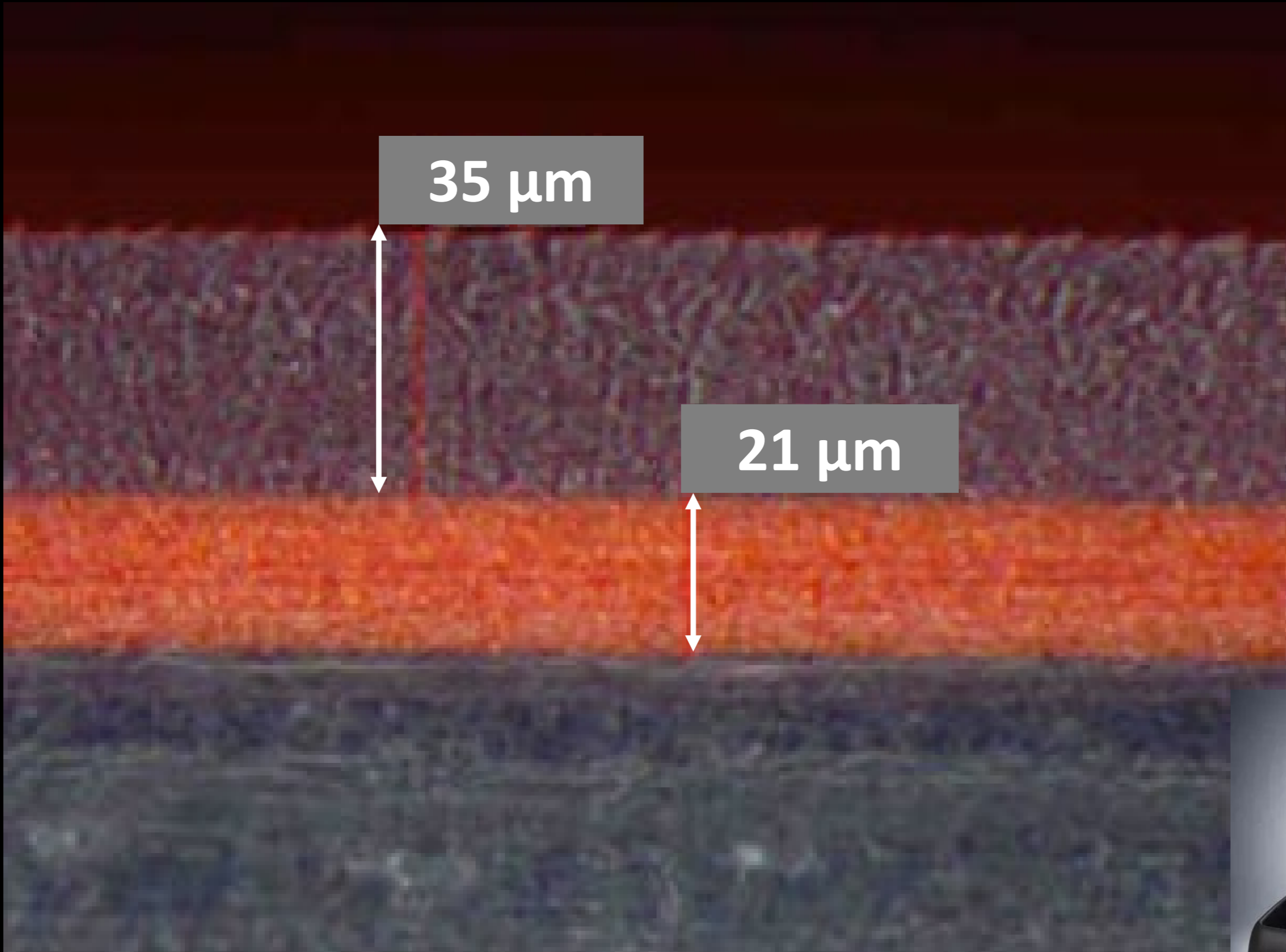
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Survey 1

What challenges will we have to face in surface technology within the next 5 years?

- Increasing shortage of skilled workers
- Rising raw material prices
- Growing quality requirements
- Advancing globalization
- Stricter environmental regulations



35 μm

21 μm

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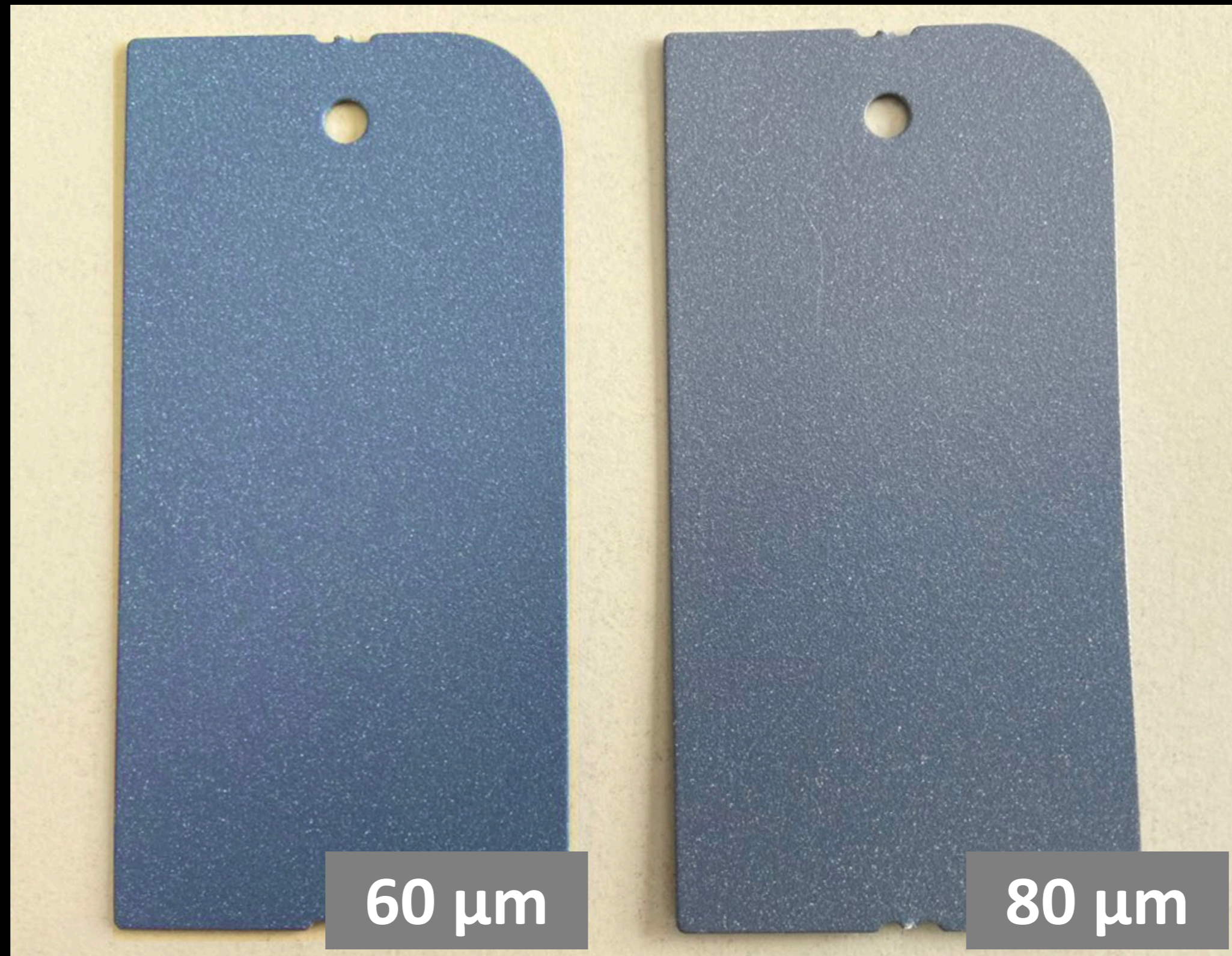


Survey 2

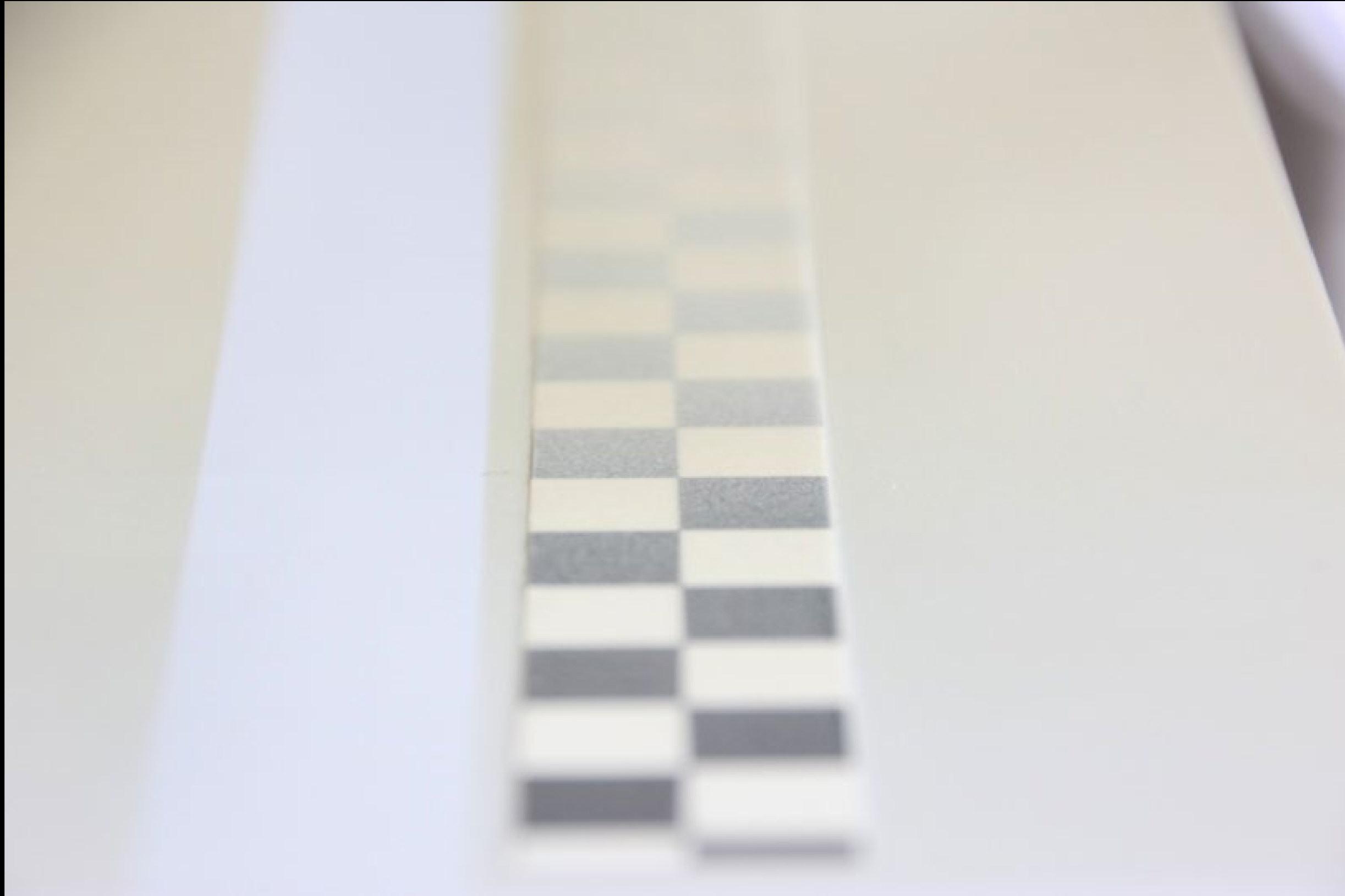
Which coating parameters are mainly influenced by the coating thickness?

- Color & Gloss
- Haptics, Cool & Warm Touch
- Mechanical properties
- Chemical Resistance
- Protection Against Corrosion

Color



Opacity



Gloss level



Texture & Haptics



Mechanical Resistance

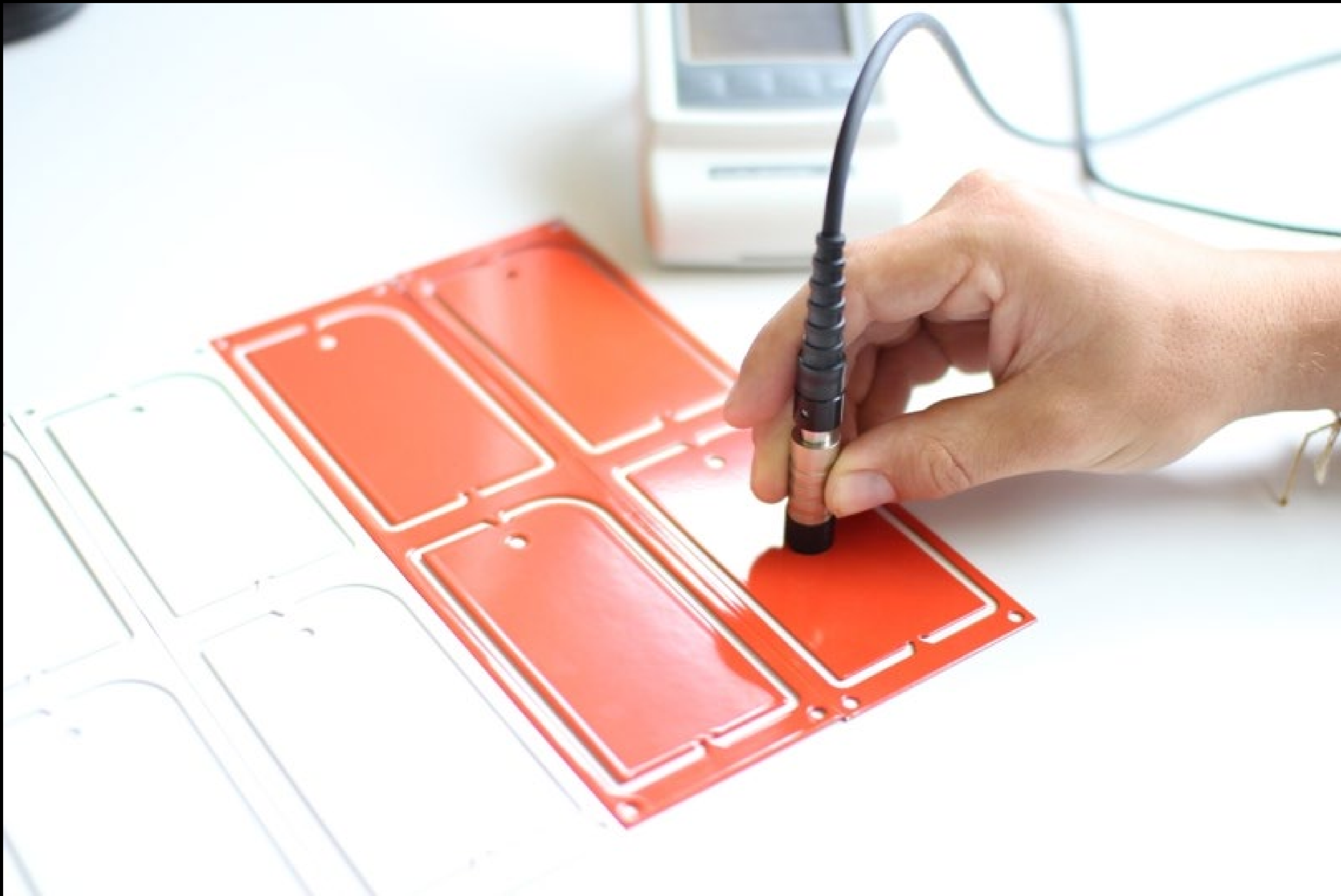


Protection Against Corrosion



Chemical resistance

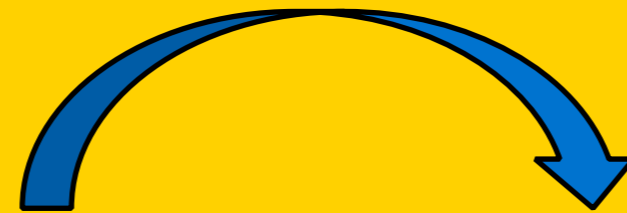






Challenges for coating control

Coating applied by screen printing process



Final product

Curing
+ Cooling
> 3 h



8 μm

9 μm

Survey 3

Which environmental parameters influence the coating thickness?

- Ambient humidity & temperature
- Environmental & pressure
- Electrical grounding
- Particle distribution & viscosity
- Wear and tear

Temperature



Humidity



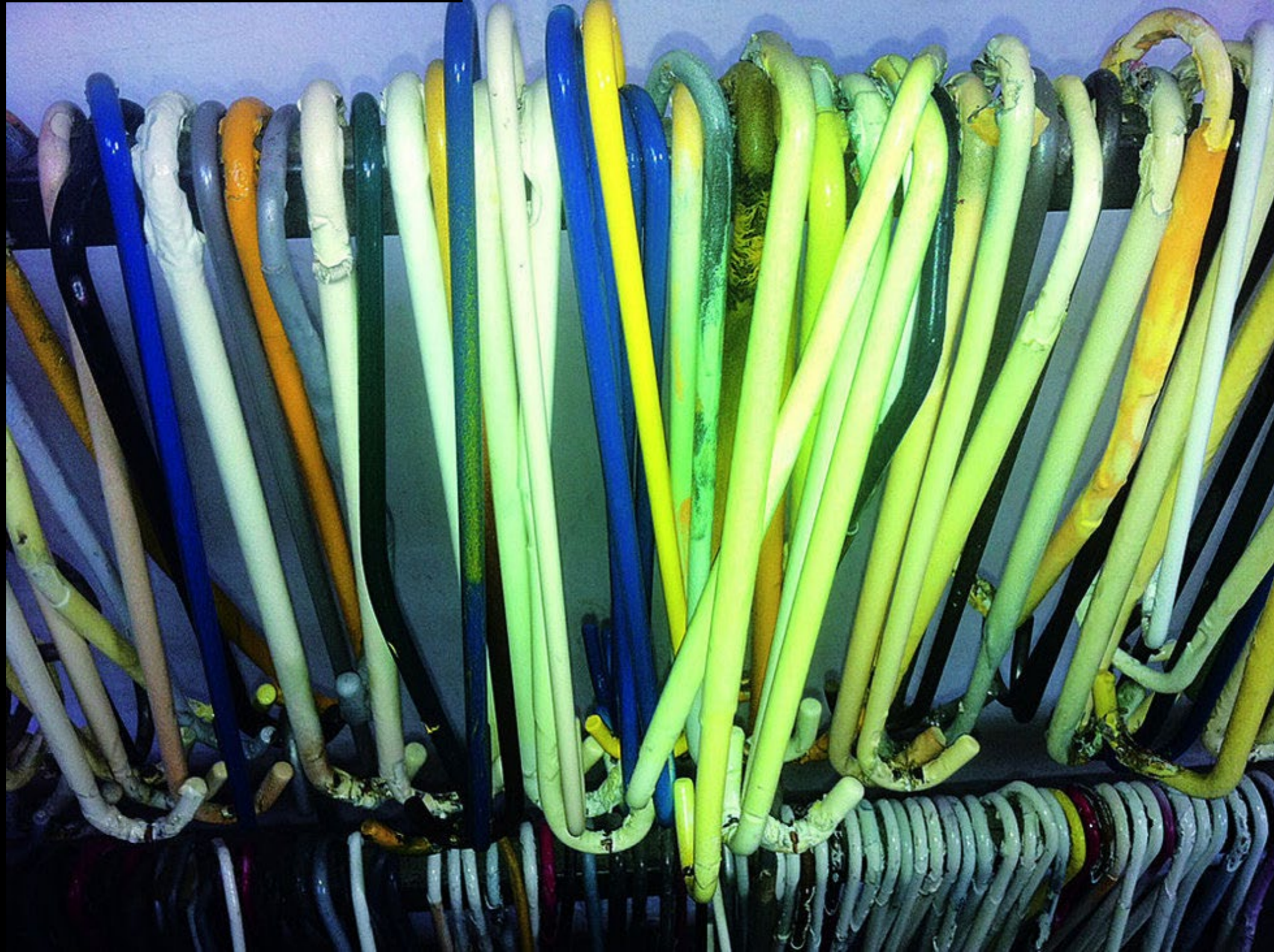
Environmental Pressure



Aging



Electrical Isolation



Survey 4

Which of the following technologies for thickness measurements do you use?

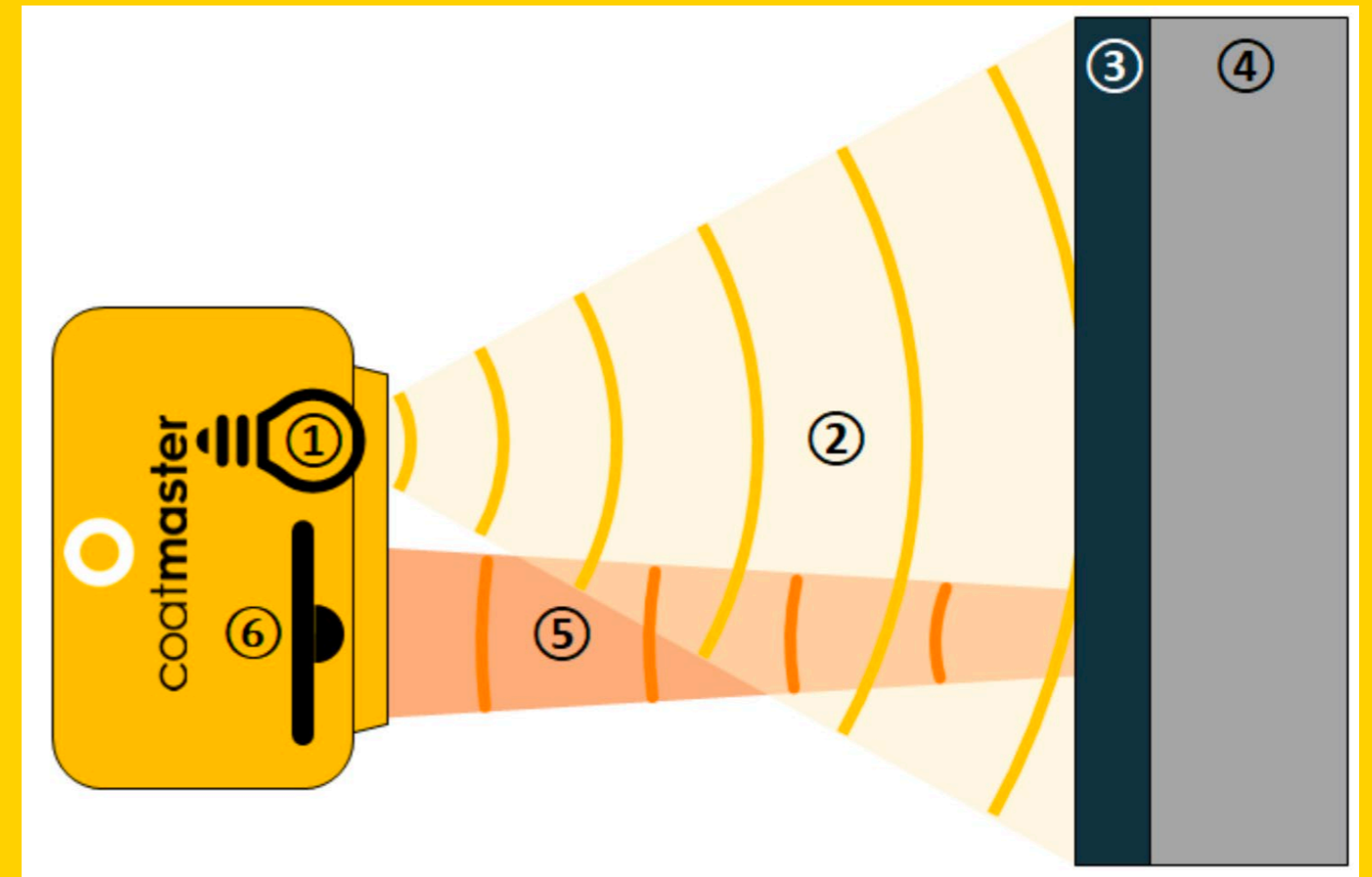
- Eddy-Current Method
- Magneto-Inductive Method
- X-Ray Fluorescence
- Photothermal Technologies
- Advanced Thermal Optics

Requirements for early coating thickness measurement

	Requirements	Eddy-Current, Magneto-inductive)	Photothermal, X-Ray-Fluorescence
Non-contact	Yes	No	Yes
Working distance	> 10 cm	0 mm	30 mm
Distance tolerance	> ± 1 cm	± 0 mm	± 3 mm
Angle tolerance	> $\pm 45^\circ$	$\pm 0^\circ$	$\pm 20^\circ$
Geometry independence	Yes	Only flat parts	Yes
Measuring area (diameter)	1-10 mm	0.1 mm	0.1 mm
Measuring range	1-1000 μm	10-1000 μm	20-150 μm
Measuring time	< 300 ms	3s	3s
Moving parts	Yes	No	No

Underlying Magic – Advanced Thermal Optics ATO

- Large-area heating of the coating by light pulse
- Non-contact measurement of the surface temperature
- Evaluation of the data with proprietary algorithms



Requirements for early layer thickness measurement

	Requirements	Airborne-Ultrasound	Photothermal	ATO
Non-contact	Yes	Yes	Yes	Yes
Working distance	> 10 cm	20 mm	30 mm	10 - 100 cm
Distance tolerance	> ± 1 cm	± 1 mm	± 3 mm	$\pm 1 - 20$ cm
Angle tolerance	> $\pm 45^\circ$	$\pm 5^\circ$	$\pm 20^\circ$	$\pm 70^\circ$
Geometry independence	Yes	Only flat parts	Yes	Yes
Measuring area (diameter)	1-10 mm	5 mm	0.1 mm	1-10 mm
Measuring range	1-1000 μm	10-100 μm	20-150 μm	1-1000 μm
Measuring time	< 300 ms	5s	3s	50 – 300 ms
Moving parts	Yes	No	No	Yes

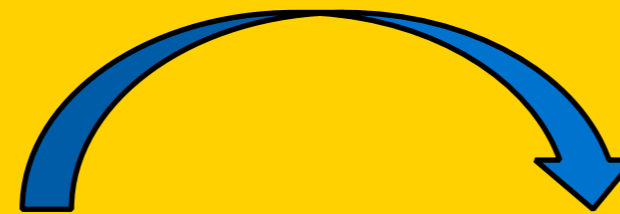


Coating control with coatmaster real-time measurement

Coating applied by screen printing process



18.7 μ m



Final product

Curing
+ Cooling
> 3 h

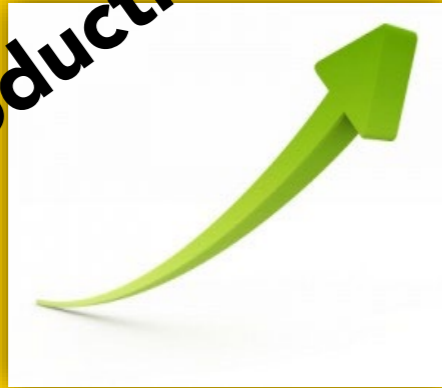




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Benefits of coatmaster process control

**Efficient
production**



- Speed up run-in time for new production batches
- Detect and correct process deviations

**Increase
profit**



- Save production time and material by producing less scrap
- Reduce customer complaints

**Automated
documentation**



- Generate automated quality records
- Access process statistics for control and optimization



Survey 5

Which aspect of controlling the coating application is most important to you?

- Automated quality documentation
- Process optimization
- Reducing scrap
- Increasing production output of coating line
- Saving coating material

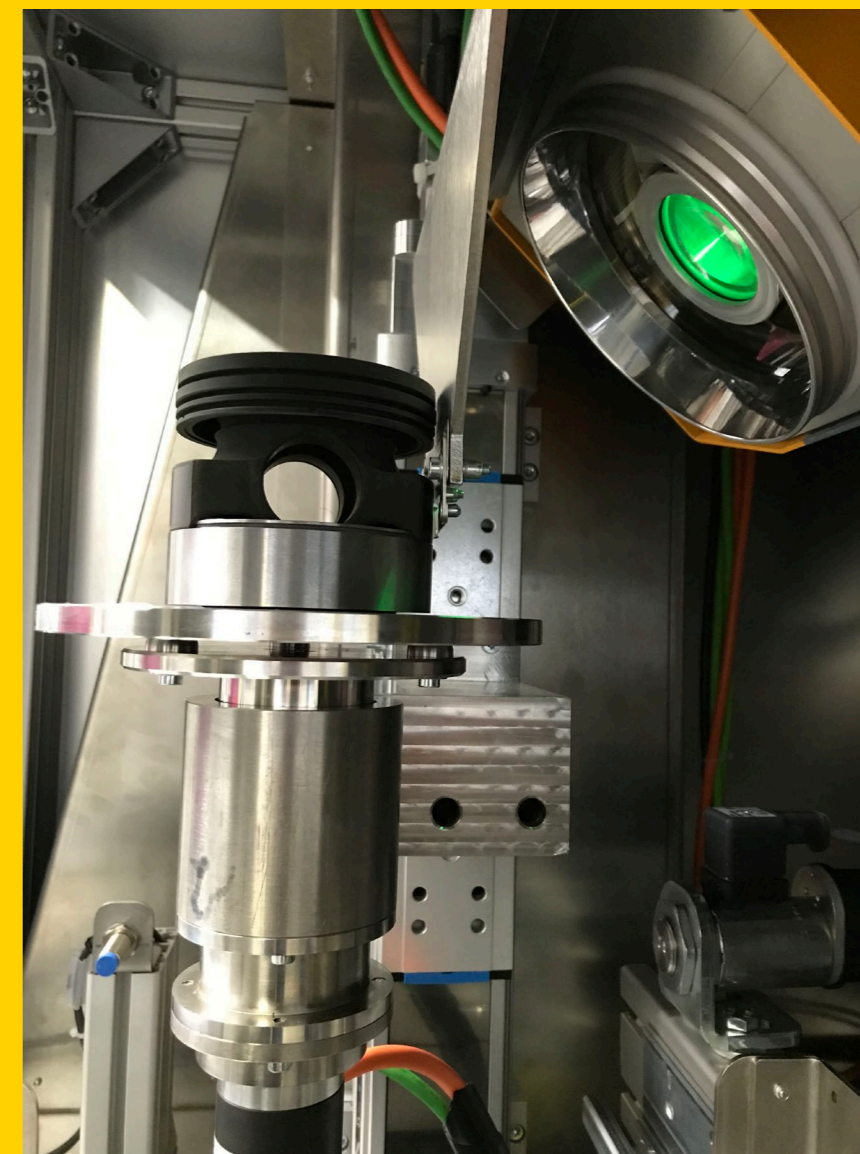
Customer example 1: Pistons from Mahle

Application:

- Wet lubricant coating applied to pistons with print screen process

Previous coating control:

- Measure coating thickness after curing with contacting gauge to ensure process tolerance
- In case of tolerance breach, rework piston (de-coat, pre-treat, re-coat)



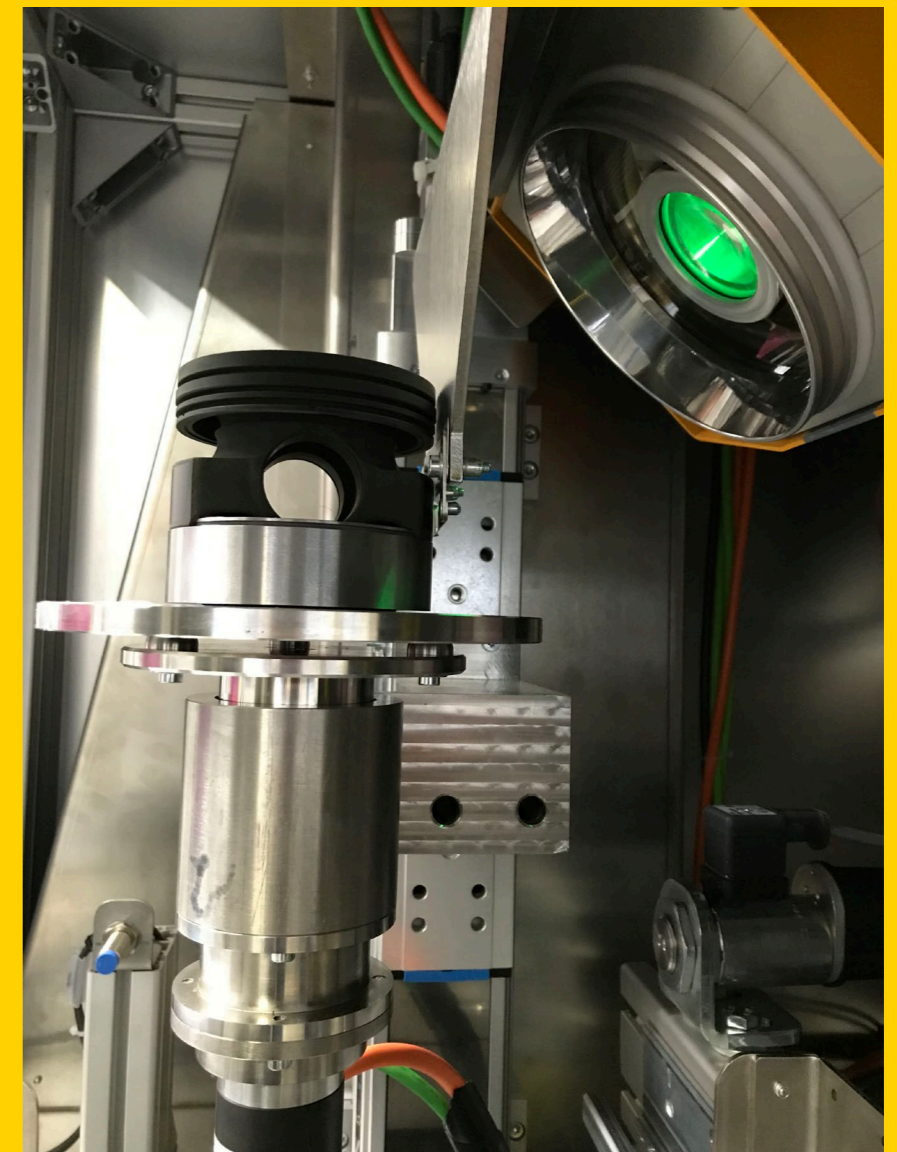
Customer example 1: Pistons from Mahle

Challenges:

- High variability with contacting gauge due to high surface roughness decreases process tolerance
- Reworks cause production inefficiency

coatmaster solution:

- Chamber for nondestructively measuring wet pistons
- Programmable measurement positions

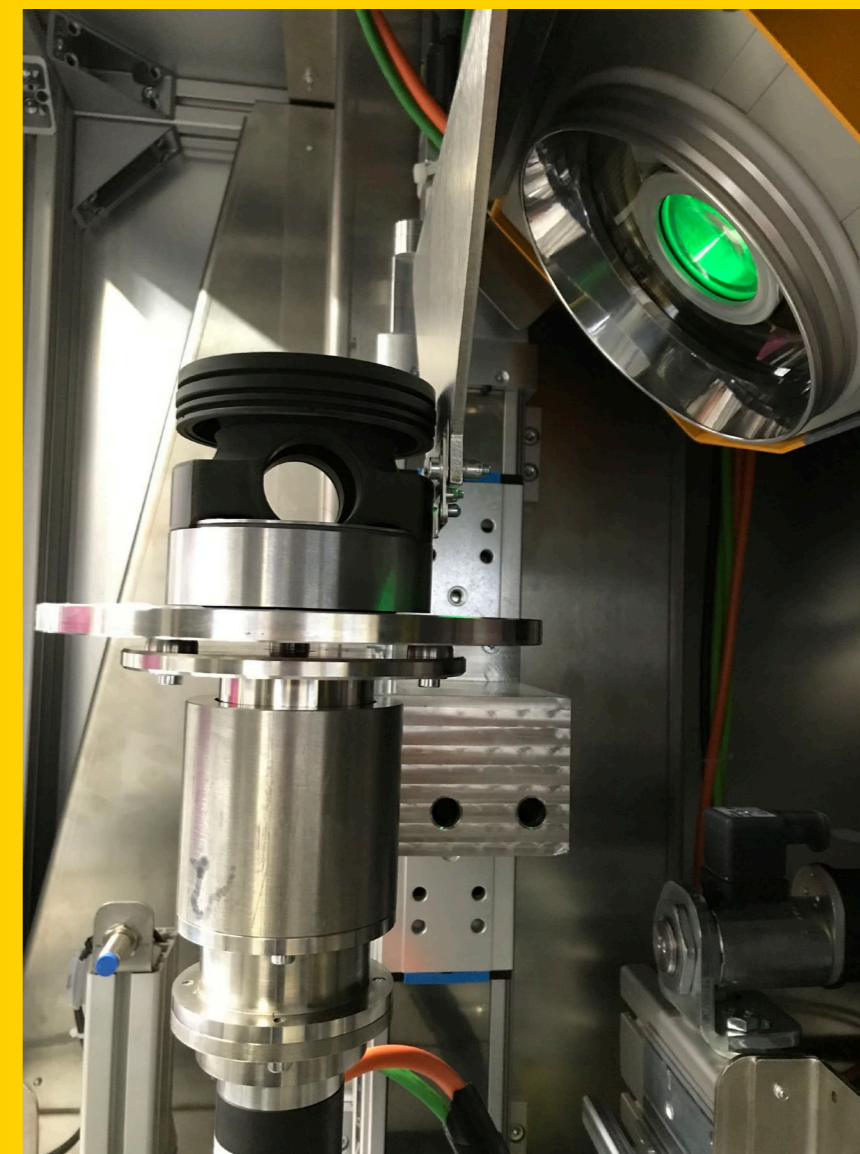


Customer example 1: Pistons from Mahle

Benefits of coatmaster solution:

- Reduced reworks
- Increase production efficiency
- Automated documentation

Improved customer relationship, higher profit margin!



Video customer example 1: Pistons from Mahle





Customer example 2

Parts for car interior from Kunststoff Helmbrechts

Application:

- Wet clear coating on plastic parts
- Flat bed coater

Previous coating control:

- Metallic coating thickness dummy plates on parts for quick measurement
- Microscopic cross-section analysis in lab



Customer example 2

Parts for car interior from Kunststoff Helmbrechts

Challenges:

- Long delay >1h
- Indirect measurement
- Long setup time for new part

coatmaster solution:

- Automated inline measurement of wet clear coat directly after application
- Closed-loop control of paint output based on coatmaster measurement



Customer example 2

Parts for car interior from Kunststoff Helmbrechts

Benefits of coatmaster solution:

- Reduced setup time
- Reduced paint consumption
- Increased production efficiency
- Full quality documentation

Improved customer relationship, higher profit margin!





Customer example 3 Torsional Vibration Dampers from AAM

Application:

- Measuring steel-rubber adhesives for torsional vibration dampers
- Spray coating process

Previous coating control:

- Manual measurement on samples with contacting gauge on sample parts





Customer example 3 Torsional Vibration Dampers from AAM

Challenges:

- Surface roughness of steel substrate
- Softness of coating
- Process uncertainty

coatmaster solution:

- 100% automated inline measurement
- Laser engraving on part for traceability





Customer example 3 Torsional Vibration Dampers from AAM

Benefits of coatmaster solution:

- Reduced scrap
- Increased production efficiency
- 100% quality documentation

Improved customer relationship, higher profit margin!





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Customer example 3 Torsional Vibration Dampers from AAM

Video 2: AAM video with robot measurement





Customer example 3

Torsional Vibration Dampers from AAM

Video 3: LAM/AAM video with automated measurement chamber



Customer example 5 Zinc Flake Coating for Corrosion Protection

Application:

- Wet zinc flake coating
- Manual and automated coating process

Previous coating control:

- Cure, wait, measure with contacting gauge



Customer example 5 Zinc Flake Coating for Corrosion Protection

Challenges:

- Complex parts
- Rough surface
- Long wait time

coatmaster solution:

- Noncontact coating measurement with manual and lab system
- Wet and dry film measurement



Customer example 5 Zinc Flake Coating for Corrosion Protection

Benefits of coatmaster solution:

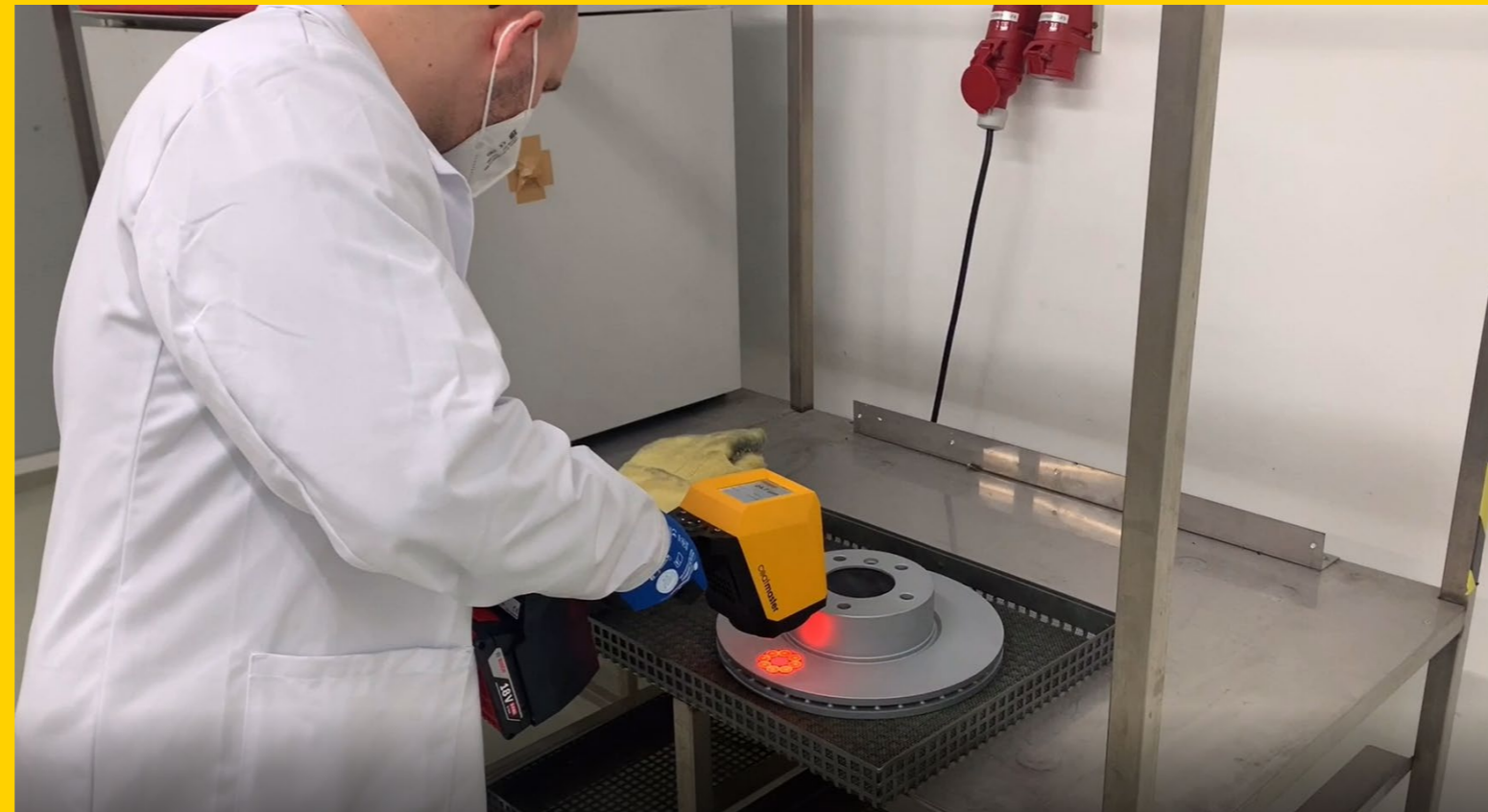
- Fast customer trials / troubleshooting
- Measurements on all parts
- Time savings for process development

Increase work efficiency in
production and onsite at customers!



Customer example 5 Zinc Flake Coating for Corrosion Protection

Video 4: Dörken





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Customer example 6 Coatings on Wheels

Application:

- Powder- & Wet-Coating on Aluminum

Previous coating control:

- Cure, wait, measure with contacting gauge





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Customer example 6 Coatings on Wheels

Challenges:

- Complex parts
- Only spot tests
- Long wait time





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Customer example 6 Coatings on Wheels

Benefits of coatmaster Flex:

- Fast trouble-shooting
- Measurements on all parts
- Time savings for process development

Increase work efficiency in production and onsite at customers!





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Customer example 6 Coatings on Wheels

Benefits of coatmaster 3D:

- Comprehensive thickness information
- Automatic documentation against liability claims
- 1st step into automation of coating processes

Increase work efficiency, save coating material, document your process!





Survey 6

How do you prefer to control your coating process?

- Single check at the end-of-line for quality assurance
- Manual measurements at the beginning and intermittently for quick process check
- Continuous measurement, in order to adjust process if trend is detected



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Thank you!

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