

Cathodic Coating Control



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CATAPHORESIS

In most automobile production plants, anti-corrosion and primer coatings are commonly applied to vehicle chassis and body parts using cathaphoresis, a cationic electrocoating method. This electrochemical process binds a paint coating to these parts, ensuring a durable, homogeneous and high-quality finish.

Parts, after other pretreatment steps (such as cleaning/degreasing and phosphating), are dipped in a cathaphoresis bath containing 80 – 90% deionized water and 10 – 20% paint solids, a mixture of pigments and resins. The parts are electrically connected to a cathode, causing to paint solids to stick to them as they exit the dip tank. Maintaining the correct balance of pigments and resins in the cathaphoresis tanks is essential to ensure the quality of the coating.

THE PROCESS

The coating solution in the dip tank is constantly circulating to prevent sedimentation and ensure the quality of the production process. As parts are immersed in the tank, the activated electrochemical process causes the coating to adhere to the metal, resulting in the removal of resins and pigment from the tank. A makeup system is used to replenish the system in order to maintain the paint solids content at the optimum level.

Determining the paint solids content can be achieved by several methods.

- **Offline laboratory determination.** Traditionally, a sample is taken and dried in a laboratory. Through weight, the solids concentration percentage can be determined. However, this is a time-consuming process, taking up to 60 minutes or more. During this time, the plant could be operating with low paint solids concentration.
- **Online measuring density and viscosity.** This multiparameter approach allows for automatic makeup of the paint solids in real time. However, the two critical measurements (density and viscosity) come with a maintenance overhead. Viscosity and density instruments are essentially mechanical devices and require periodic recalibration and cleaning.
- **Online measurement using NIR Spectroscopy.** Installing a spectrophotometer in the recirculation loop of the tank provides real time measurement of paint solids to allow the tight control of concentration in the tank. With no moving parts, maintenance is minimal.

THE OPTIMUM SOLUTION

An in-line Polisppec NIR system was installed in the recirculation loop of a cathaphoresis system to continuously monitor the concentration of total paint solids in the coating bath. This allowed the establishment of a precise set point for automatic solution concentration control.



Pipe Mounted NIR Polisppec Unit

As a result, it was possible to always maintain paint solids within the bath in a range of 14 – 18%. This tighter band of control improved the uniformity of coating and eliminated the need for periodic sample checks to track the paint solids concentration in the system.



RESULTS

The integration of the Polispac NIR system enabled:

- Accurate measurement of paint solids in the cataphoresis system.
- Accurate control of paint solids at their optimal concentration in real time
- Avoidance of overdosing and underdosing.
- Improvement of the uniformity of coating, reducing process variability and rework/waste.

By monitoring the solution in real time, the overall quality and operational efficiency of the coating process was improved. The need for periodic sample checks requiring dedicated laboratory personnel was eliminated, as was the waiting time for sample drying and incineration.

CONCLUSION

The painting and coating of vehicle chassis using E-Coating relies upon the consistent makeup of the coating material to ensure it always has the correct proportion of pigments and resins needed to provide a flawless finish. Using a Polispac NIR spectrophotometer, the concentration of the various components in the coating material are accurately monitored, providing precise feedback to the makeup system so that optimal coating material composition is maintained.

POLISPEC NIR

Polispac NIR is a robust and compact industrialized spectrophotometer that integrates reflection measurement optics (also configurable for transmission or contactless applications). Designed for both manual use and for in-process installation, it is made with special technological devices such as to make it highly performing in terms of sensitivity, operating dynamics and signal cleaning.

These qualities make Polispac NIR suitable for analyzing very different matrices, from the most reflective to the most absorbent, without the need for different versions of the instrument for each application area.



- **Real Time Measurement:** Solids concentration reported in real time
- **Accurate Control:** Real time measurement allows for continuous control
- **Stability:** Automatic concentration control prevents manual overdosing and underdosing
- **Quality:** Tight concentration control improves the uniformity of the coating, allowing post-coating processing to be more consistent
- **Cost Savings:** No time-consuming manual testing required



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