

ENAMEL COATING



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Key words Enamel, wet painting, Powder Coating, Booth System, Spray Gun

The topic(s) covered by the paper

1. What is the enamel & use?
2. What is the wet painting & powder coating?
3. What is ITW Gema supplying for enamel application?
4. How does ITW Gema Equipment improve enamel coating quality?
5. Case study introduce.

Objectives Introduce what is enamel powder coating & how ITW Gema help customer to improve enamel coating quality and productivity.

The results and conclusions ITW Gema supply not only good enamel powder coating equipment but also the advanced technic and total solutions for customer enamel application.

The enamel powder coating technology

Powder coating is an advanced method of applying a decorative and protective finish to a wide range of materials and products that are used by industries and consumers. The powder used for the process is made out of porcelain particles (1 - 100µm). The particles are enveloped by a silicon coat to make them electrostatically chargeable. The charged powder particles adhere to the electrically grounded surfaces until heated and fused into a smooth coating in a curing oven. The result is a uniform, durable, high-quality and attractive finish. Powder coating in general is the fastest-growing finishing technology in the world.

In the middle of 1970s, some overseas companies started to test the possibility of enamel powder coating encouraged by the outstanding advantage of organic powder coating. From then on, enamel powder coating technology became popular all over the world. With the technique increasing and the experience accumulating, the technology of enamel powder coating has wide range of application in cookers, microwave oven、 bath tub、 water heater、 industry enamel product etc.

What Are the advantages of powder coating in comparison to wet coating?

More Durable And Best Surface Quality

Powder coated surfaces are the longest-lasting and most resistant to chipping, scratching, fading, and wearing. It offers a very smooth layer combined with a unique coating thickness. The temperature resistant is up to 350 C.

The fully automatic coating process recovers the overspray powder up to nearly 100% to re-use it. No milling process is required, the powder is supplied ready to use for production. No dryer required (energy and space savings).

All these benefits result a significant saving of money and improves the economic of the process.

Process technologies

For enamel coating are different process technologies available. For oven cavities or flat panels is the direct enamelling process preferable. The direct white coating is standard for lids and tops.

The combined coating process are divided in two groups: the 2 Coat 1 Fire process and the 2 Wet 1 Fire process. This means to coat wet for the grounding and a combination of wet and powder for the top coating.

Customers expectations

Enamel powder coating fulfils many expectations. The main key benefits are listed here:

Improved production flexibility due to:

A wide variation of baking ovens in size and shape can be coated with nearly no limitation. Even mixing baking oven and flat panels are easily to handle.

Cost reduction due to:

Precise coating of flat surface and corners, bending etc..
The significant increase of the first pass transfer efficiency.
A superb minimization of film thickness variations.

Minimum reject rate due to:

Process repeatability and process stability.
Automatic program change in between of different products.
No manual interference due to high degree of automation .
User friendly programming surface with Touch Panel screens.

Improvement of the quality of the surface finish:

No orange peel of the surface.
Even and regular distribution of sprinkled powders.

The ITW Gema Enamel products in detail

The MRS Booth System

The MRS system can be designed in a wide variety of configurations. Whether for white or ground enamel, whether for inside or outside enameling, whether for flat parts or for cavities, whether in a pure automatic configuration or combined with one or more manual coating stations, the MRS is suitable for all kind of applications.

The MRS booth creates ideal airflow conditions for an efficient enamel application. The outstanding separation efficiency of the sinter-lamella filters avoids enamel losses and ambient contamination.

The recovery system is integrated in the booth walls. This very compact solution prevents the deterioration of the enamel powder quality in the recovery circuit. No ducts means no enamel deterioration and better application quality.



The booth floor is flat and allows easy and safe access for maintenance. Booth walls are available in different materials for every customer need. In robust and wear resistant stainless steel or as plastic sandwich construction. The later is featuring reduced powder accumulation and easier cleaning thanks to their seamless and non conductive surface.

The simple and robust design, the long life-time of the filters and of all the other components makes the MRS the ideal solutions if you are looking for a reliable system with reduced maintenance costs and quick return of investment.

Automated floor cleaning

The optional squeegee system cleans the accessible floor booth continuously. Less enamel is left on the floor and the cleaning time is reduced significantly.

Recovery and Filter System

The compact MRS enamel powder circuit aims for ease-of-use, continuous and consistent enamel feed and little wear of parts. The injectors, pumps and recovery system are perfectly coordinated with one another and feature a wear-resistant design.

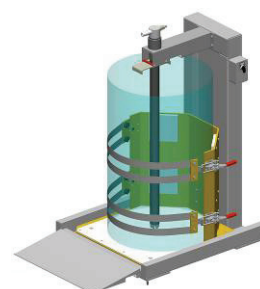
A wide variety of fresh powder feed and sieving solutions are designed to meet all quality requirements. The rotary sieving machine includes a carbon fibre sieve and is connected directly by a powder tube to the powder hopper.

The sinter-lamella filter elements have an outstanding 99.99% separation efficiency. Thanks to their very robust construction they have an exceptionally long life-time with the smallest maintenance costs.

The dust amount from the filtered air is below 0,01 mg/m³ thanks to its special structure (porous and rigid). It absorbs the noises perfectly and lasts for a very long period of operation.

Fresh powder supply system

To maintain a constant powder quality, an automatic fresh powder supply is recommended. The ITW Gema Fresh powder supply system (option) transports automatically and exactly the powder from big container, drums or big bag to the powder hopper.



The fresh powder can be supplied from different systems as BigBags, Drums, Pallets and Octobins.

The key of the constant powder supply is the Powder Pump PP05 which is particularly suited to powder conveying over long distances directly from the original powder bin.

The benefits of the OptiFeed Powder Pump PP05 at a glance:

- Conveying of large powder quantities over long distances and height differences
- Gentle powder conveying with little air
- Cleaning program
- Powder hose emptying
- Maintenance interval supervision
- Easy start-up
- For organic powders and enamel powders

OptiGun Powder Gun

With high transfer efficiency, a uniform enamel application and optimal penetration into any geometry represent the ITW Gema guns the heart of the enamel coating process. The robust construction with wear resistant components is another highlight of the guns. The excellent ergonomics and the lightweight design of the manual guns guarantee fatigue-free operation.

All ITW Gema products are designed to minimize the maintenance time and costs. All the main gun and injector components are made in wear-resistant ceramic material. They can be disassembled in shortest time for cleaning or inspection.

The gun current limitation adjustment significantly reduces the back ionization effect and improves the application quality. The patented DVC (Digital Valve Control) technology ensures a precise and constant enamel delivery. This results in a more uniform layer thickness distribution and lower enamel consumption.

The optional SuperCorona® collects and neutralizes the free ions that would disturb the powder deposition on the object. This improves the surface quality significantly and reduces the elimination of the so called orange-peel effect.

To comply with the abrasive enamel powder, the ITW Gema guns are specially designed. The inside of the gun and all powder contacted parts are made of technical ceramic material. This guarantees the life of Gun and quality of coating. A wide range of nozzles for specific applications is available and includes deflectors, deflector plates, flat spray nozzles and angled nozzles.



The benefits of the OptiGun at a glance:

- Constant powder output and uniform powder charging
- Patented, integrated electrode rising = constant charging
- SuperCorona® against “orange peel” finish
- Easy to service and long-life
- Manual powder guns with integrated remote control built-in
- Exact spray current adjustment in combination with the OptiTronic control unit
- Quick-change coupling for problem-free color changes
- Completely sealed gun body, increased operating safety
- Varied nozzle program optimized for friendly maintenance



OptiStar – ergonomic and intelligent:

With the control module OptiStar you have a grip on all coating parameters. Clear symbols, simple programming and a perfect reproducibility of your results contribute to measurably increase your coating quality.

The OptiStar control module with DVC (Digital Valve Control) technology guarantees an accurate and reproducible coating result. Three standard programs for flat parts, profiles and re-coating and 250 customized programs are available via the Display Pilot.

OptiStar is producing quality always at it's best, reproducible time after time!

The programmable powder output is adjustable from 0 – 500 gr/min in steps of 2%.

During the coating process of a baking oven different powder outputs can be programmed, for flat surface coating and corners. The automatic program changes for different products.

The benefits of the OptiStar at a glance:

- Reproducible coating results at all times
- Programmable high voltage and current limitation
- Optimum transfer efficiency
- Separate and exact setting of all coating parameters
- Programmable high voltage and current limitation
- Consistent powder charging
- Uniform powder output from all guns
- Constant build-up of the coating film structure
- Constant spraying pattern
- Reduction of the average coating thickness = Powder savings
- Continuous compensation of compressed air and dynamic fluctuations



Touch-Screen Controls

With the control module OptiStar and MagicControl you have a grip on all coating parameters. MagicControl CM-10 and OptiControl CM-20 enable to overview the entire powder coating system and to choose all parameters directly via the screen. The user friendly programming surface gives you the possibility for the setting of all relevant parameters. The clear icons and action messages offer your coaters an intuitive operation of the control systems.



The MagicControl and the OptiControl enable the comfortable programming and individual storage onto CompactFlash memory cards. Call up your specific programs via the icons to repeat your coating results at any time.

The benefits of the PLC Control Systems at a glance:

- Individual adjustment of the powder output per gun
- Current limitation per gun
- Reciprocator adjustment of speed and stroke
- Program storage on CompactFlash cards
- Full process control
- Connectable to Production Process Control system

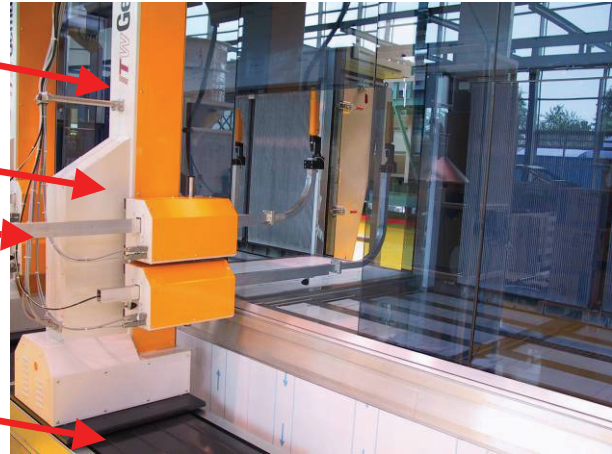
Reciprocators and Axis

ITW Gema's reciprocators and axes cover all movements. The combination of the different axes guarantees the correct positioning of each individual gun. The gun movement follows the object size. No matter what configuration you need, whether a horizontal or vertical axis, an infeed or rotary axis, we have a solution for all your requirements. High precision synchronized axis ensure the best quality in inside coating applications.



Sample configuration for enamel coating:

- Vertical Z-axis
(short stroke / long stroke)
- Horizontal X-axis
(in / out movement)
- Horizontal U-axis
(individual gun movement)
- Special designed axle
- Synchronized Y-axis
(conveyor speed related)
- Special designed axes
according customer requirement



The benefits of the reciprocators at a glance:

- Available as one or multi-axis versions
- Ideal for long or short strokes
- All axes freely programmable
- Extremely quiet running with the toothed belt drive
- Heavy loading and high stability
- Narrow column permits space saving configuration of the guns
- Maintenance-free AC motor drive

The Electrolux cookers plant in Poland

ITW Gema has a full range of solutions, developed specifically for the porcelain enamel coating. Wear resistant constructions, high transfer efficiency, outstanding application quality, short return of investment are the common advantages of our enamel systems. This benefits were the reason for Electrolux to choose ITW Gema products for their new plant in Poland.

Brief History

The new Electrolux cookers plant in Świdnica is the fourth one of Electrolux Group in Poland. Currently Electrolux produces dryers in Siewierz, dishwashers in Żarów and washing machines in Oława.

The construction started in November 2005 on 30 ha of land. The project consists of production halls with combined floor space of 22,500 sq. m., ready-made products warehouse with floor space of 5,500 sq. m. and office space of 2,700 sq. m. Electrolux will invest over EUR 40 million and will create 350 jobs in production, managerial and office divisions. New factory will employ 50 people in 2006 and another 150 in 2007.

Świdnica plant meets all Electrolux Manufacturing Systems (EMS) requirements. EMS is a program defining highest production, supplying, quality, freight-forwarding and logistics in Electrolux Group factories. "The advantage of this system is that it uses best standards that allow for such organization of production, that allows quick reactions to consumers needs, so that we can produce everything according to demand. This system makes it possible to improve the quality, thanks to

very detailed quality control process and clearly delegated responsibilities” said Horst Winkler, Senior Vice President Industrial Operations Europe Electrolux.

Production in Świdnica started at the end of December 2006, exactly 16 months after signing a contract with the city council. During the first year (2007) production amounted to 147,000 cookers. In two years the factory will reach its full production and will manufacture 490,000 products a year. The company estimates that 90% of production will be exported mainly to European Union and developed countries. Most of materials and components needed in the production process will be delivered by Polish suppliers, which will create new jobs.

“At this moment we are concentrating on recruitment for our three factories in Silesia. Electrolux is renowned for creating friendly and safe work conditions. We believe that soon we will build strong teams of satisfied workers in Żarów, Olawa and Świdnica,” said Zbigniew Sporna, Managing Director at Electrolux Poland. “Thanks to large scale of activities in Poland we will be able to offer stability of employment, as well as attractive positions and job promotions for the best.”

Source: http://www.paiz.gov.pl/nawosci/?id_news=1029&lang_id=1

The ITW Gema Enamel Installation

LINE 1 – CAVITIES ENAMELLING LINE

- **MRS** automatic coating booth, **MRS - EF 70-18-200**
- Work-pieces recognition system (gap control)
- Electrostatic unit, **OptiMatic-2 / 18 GE**
- Vertical reciprocators, **ZA02 / 13 + YT02 / 08**
- Fresh powder system from **big-bag**

Production data:

Product type:	Oven cavities
Enamel type:	Ground powder

Time production: 230 days/year, 15 hours/day. Inside cavity and outside enamelling.

External dimensions of the object

Max. Height	410 [mm]
Max. Width	370 [mm]
Max. Length	480 [mm]
Operation conveyor speed:	3,2 [m/min]
Hanger pitch:	812 [mm]



The ITW Gema Enamel Installation

LINEs 2 & 3 –PANELS GROUND ENAMELLING LINES

- **MRS** automatic coating booth, **MRS - EF 65-18-200**
- Work-pieces recognition system (gap control)
- Electrostatic unit, **OptiMatic-2 / 24 GE**
- Vertical reciprocators, **ZA02 / 13**
- Fresh powder system from **big-bag**

Production data:

Product type: Flat panels
Enamel type: Ground powder

Time production: 230 days/year, 15 hours/day, efficiency 90%.

External dimensions of the hook

Max. Height	600 [mm]
Max. Width	250 [mm]
Max. Length	600 [mm]

Medium conveyor speed:	5 – 5,5 [m/min]
Hangers pitch	812 [mm]



The ITW Gema Enamel Installation

LINE 4 –PANELS WHITE ENAMELLING LINE

- **MRS** automatic coating booth, **MRS - EF 60-18-200**
- Work-pieces recognition system (gap control)
- Electrostatic unit, **OptiMatic-2 / 20 GE**
- Vertical reciprocators, **ZA02 / 13**
- Manual coating booth, **Classic E**
- Manual electrostatic unit, **OptiFlex W-E**
- Fresh powder system from **big-bag**

Production data:

Product type: Flat panels
Enamel type: White powder

Time production: 230 days/year, 15 hours/day, efficiency 90%.

External dimensions of the hook

Max. Height	600 [mm]
Max. Width	100 [mm]
Max. Length	600 [mm]

Process conveyor speed:	2,8 [m/min]
Hanger pitch	812 [mm]



The history of U-JIN:

For the past 50 years, U-JIN has specialized in enamel coating and nonstick coating. As an industry leader in the Korean enamel business, we are proud of what we have achieved for the domestic market. We have also focused strongly on developing new innovative technology that meets the market's changing needs. Our products are widely chosen for home appliance, power plant equipment, cast iron and AL. Products etc.

We developed our U-JIN powder in 1994 and we have been able to apply this material to produce a superior reinforced nonstick coating on enamel steel. Having the characteristics of "easy to clean" and excellent durability. We export our coating products to overseas market and have gained a high reputation for quality performance.

The new powder coating installation at U-JIN in QingDao, ShanDong, China

Objects

Kitchen Coating Utensil

Product Size

H 1500 mm

W 75mm

Scope of delivery

1 x OptiMatic/AS02 OptiMatic/AS02

30 x GA02-E Automatic Gun

2 x ZA02-18 Reciprocator

1 x MRS-F

1 x ICS with Gematic

Conveyor speed 4.5m/min

Layout

Main View Side View