

Innovation with all aspects

Modular lacquer manufacturing follows a completely new concept

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new principle

Modular lacquer manufacturing follows a completely new concept

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The basic procedures in the industry for lacquer and paint have not changed since the introduction of the silo technology about 50 years ago

A recent start-up of a high-tech production for lacquer and paint eventually will set new trends. The set-up is modular, does not need any silos and produces independent from the batch size.

roduction of lacquer and paint can be considered as a conservative branch with a highly empiric factor in the chemical sector. Of course there are continuous improvements of the recipes, individually optimised processing steps and computer controlled modernisation.

A real and comprehensive innovation was not in sight for a long time. In May 2006 a new production line for automotive hydro fillers has started up in Klingenberg that proves that there are other possibilities: the modular production facility for lacquers and paint of the medium sized automotive lacquer producer Hemmelrath is based on a completely new concept for the production of lacquer and paint.



Widespread requirements

A capacious vision was the beginning of the development. What could and should be done for a different high-tech process.

Independence from batch size

The new production should be almost independent from the given batch size. For larger orders and volumes as demanded by customers from the car manufacturing industry, until today several smaller batches have to be combined. For larger batches a processing system is required that may handle such large volumes of product on the other side, the same system should be capable to handle medium sized batches as well.

No silos

One special demand on the to-do-list was the use of a small space only while providing a high efficiency in the same time. The large silos nowadays used in the production of lacquer and paint do not only require a lot of space but as well a lot of energy and time: raw material has to be transported under pressure into the silos and the again transported form the silo to the processing system. The new system had to be designed without the use of any silos.



Picture 2

With the rotor-stator-system powders will be dispersed within a fraction of a second

Picture 3

Main component of the processing module is a Conti-TDS Dispersing unit that is being fed from a powder storage vessel as well as from BigBags. The processing vessel is being homogenised by a Jetstream mixer



Picture 4

The Jetstream technology creates a stream to effectively mix the product without forming turbulences and a Vortex

Flexibility

Children know it from Fischer building blocks, the same principle may be applied for processing systems: a modular system. Such a concept provides a much higher flexibility of the processing system, products with different consistency may be treated, and the individual modules are only in operation when they are required.

Higher efficiency

Another crucial point was the demand for a much higher effectiveness compared to the output of conventional production systems.

For a conventional dissolver system about 80% of the energy input is converted to heat - lost energy and contra productive as well. The fast turning disc of a dissolver produces a shear gradient in a high viscosity paste. As a result, particles in the product are des-agglomerated. Due to the heating up of the product, the viscosity rapidly decreases - the shear effect is reduced and not effective anymore.

Another problem – especially when producing water based paint – is the air that is being incorporated into the product during the dispersing process. As an additional step, this air again has to be removed from the product.

No emissions

The newly designed modular production system for lacquer and paint should operate in a clean area and almost free of any disposal – the demand for a completely closed system. Almost no emissions for a better environment and protection for the workers, less disposal, less cleaning requirements – an all around clean solution was the aim. The focus of all these considerations was the required quality of the products for one of the most demanding customers of the manufacturer for paint: the automobile industry.

Broaden the horizon

To realise the catalogue of requirements it was necessary to go for completely new and unknown paths. One inspiration was given by another economic sector: the food production industry. In the production of food many similar production steps are being used, same as in the production for lacquer and paint. In comparison, their technical level is much higher. Why shouldn't one or the other solution in the food industry being used in the production for lacquer and paint?

Thanks to these methods it was possible to replace the existing conventional semi-automatic production with dissolvers at Hemmelrath with a maximum capacity of 5 tons per batch and a production capacity of 7.000 tons per year and the time consuming silo dosing system and the standard grinding processes with an innovative production system. The new processing system provides a production volume of 5 to 40 tons per batch a reaches a production capacity of 20.000 tons per year. In the same time it requires only 50% of the energy.

Its secrets of success:

- •Rotor-Stator dispersing techniques
- Jetstream mixing technology
 Desing of liquid raw mat
- •Dosing of liquid raw materials (slurries, coloured paste, semiproducts)
- •Efficient grinding techniques
- Online silo emptying
- •Handling of the process in a closed system
- •SPS controlled service and maintenance

Rotor-Stator-Technology

Instead of using the conventional dissolver the dispersing of the powdery raw material to be treated now is carried out by a main module of the system. Main component of this module is an ystral Conti-TDS dispersing unit (TDS = Transporting and Dissolving System) which works according to the principle of the rotorstator-effect (Picture 2). The medium is axially inducted into a dispersing head diverted by 90° and then squeezed through the slots of the rotor. The rotor runs wit a very high speed of up to 3.600 rpm. The stationary stator as well is equipped with slots and the medium leaves the system through the same. During this passage, the medium is exposed to very high shear energy. With-in a few milliseconds, the inducted powder is wetted and completely dispersed. One ton of powder may be wetted in about 3 minutes. As this dispersing unit is a completely closed system, no air will be incorporated into the suspension.

When specifying the parameters, the problem was clear: such a dispersing unit with the required size and the given speed profile was not available on the market. A highly specialised company was given the order to develop such a large TDS module.



Picture 5 Mixing tank module of the modular manufacturing of lacquer



Picture 6 The bead mill of the grinding module uses a drive wit 200 kW and with a volume of 540 litres in the grinding chamber it can grind more than 10 tons of products per hour



Picture 7 The control of the whole system is handled by portable soft-touch Laptops and WLAN

This new type now operates with a power of 250 kW, a pumping rate of 90 m³/h and a maximum energy input in milliseconds. Picture 3 shows such a module

A positive aspect of the disperser according to the rotor-stator principle: because of the high speed of the rotor, a vacuum is created in the dispersing chamber. The process module uses this vacuum to induct powders from a powder container respectively Big-Bags into the dispersing unit. The powder storage container is directly fed from the silo on a truck. With this technology, the load of a truck is unloaded and dispersed - in less time than needed for the conventional pumping of the powder into a silo only. Large manufacturers of dispersed lacquer and paint use about 50% of their investment volume for the silo technology. The new technology offers the miracle to supply the powder from silos on trucks without the use of storage silos on site.



From the dispersing unit the dispersed and wetted powder reaches one of the two processing tanks with a volume of 30.000 litres each. Here as well no conventional technique is being used: instead of using a standard stirrer, a vstral Jetstream mixer is installed to homogenise the product.

The principle of a Jetstream mixer as well is based on a rotor-statorprinciple: in this case, the stator has the form of a guiding pipe and surrounds a fast rotating three blade rotor which again creates a liquid stream (Picture 4). The guiding pipe directs the liquid stream directly to the bottom of the vessel and thus avoids that the contents in the vessel starts to rotate. At the bottom of the vessel, the liquid stream is separated and rediverted to the outer wall and forms an upwards directed stream towards the surface of the liquid. When it reaches the surface, the medium again is drawn to the centre of the vessel and causes a complete circulation of the medium in the vessel and thus achieves an immediate and homogeneous distribution of the product. As the rotor rotates in the lower part of the vessel, the surface of the liquid remains calm, no Vortex builds up and no air is incorporate into



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Picture 8 Liquid additional components are being added by the aid of these modules with a high accuracy and within seconds

the product that later on again has to be removed with a lot of energy. The unit works independent from the filling level in the vessel, for his reason small batches as well as large batches may be produced in the same system. The use of a Jetstream mixing system requires much less energy compared to conventional mixers.

Not only he processing unit is equipped with Jetstream mixers, all other mixing tanks, slurry and binder semi product modules are equipped with this technology (Picture 5). The Jetstream mixers are adjustable in speed and are equipped with drives up to 30 kW.

A bead mill breaks records

Main reason for the limit of production for the production system that started in 1999 was the use of conventional milling systems. Bead mills are the bottle necks of each production as they reach a capacity of about 1 ton per hour only. The technology of the bead mills again should be part of the new production system as an especially fine and effective grinding for automobile lacquer is required by the automobile industry. Target was to drastically increase the flow rate. Until this time there was no bead mill available for the treatment of lacquer with a flow rate that even came close to the required value. The solution again was the development of a special system. This bead mill now breaks all the records and currently it is the largest existing mill in the production of lacquer and paint.



surface in all corners of the vessels

With a power of 200 kW and a volume for the grinding chamber with 540 litres it can handle a volume of more than 10 tons of product per hour (Picture 6). The electric control of the grinding module was developed by the manufacturer and integrated into the existing PLC control system.

Complete homogeneous batches with higher quality

Customers from the automobile industry for the hydro filler demand a particle size of about 15 µm. The new production system now offers a product with a particle size fare below this limit.

Due to the independence from the batch size, the customer now achieves a homogeneous batch with a much higher quality. Other advantages of the modular system are shorter production and processing cycles while simultaneously achieving a higher flexibility because of the use of liquid components and raw materials. The service and maintenance is monitored by a PLC controlled system and thus increases the availability and the reliability of the whole system.

The new concept eliminates a lot of simple working procedures such as cutting open the bags or cleaning procedures. These free capacities now can be invested into the fine tuning of the properties of the product to again improve the level of quality. This should be the main competence of a manufacturing of lacquer and

paint in a highly technical facility in Germany.

Picture 10

The automatic cleaning

module provides quick

and reliable clean

Perfect tuning of the modules is essential

The 13 individual modules have to perfectly lock into each other to guarantee a trouble-free operation in the production. The control over the system is carried out by two portable soft-touch Laptops (see Picture 7) and WLAN. More than 2.800 signals are combined with each other. A module containing additives (Picture 8) is responsible for the exact and fast adding of the liquid components (300 m3/h) instead of pumping or pressing it into the mixing vessel.

Dosing of coloured paste or auxiliary materials is carried out below liquid level, incorporation is carried out without any splashing around - an exceptional clean procedure. The modules that have to be connected to the mixing tank module are equipped with special valves without any dead zones and thus guarantee the completely closed system. Picture 9 shows this module for coloured paste and auxiliary materials.

Concerning the environmental and labour protection, the new modular system places a new benchmark as well. No littering around, no dust in the air. Other essential details are the use of weighing cells that are

Results on a glance

At Hemmelrath, a manufacturer of automobile lacquer and paint an innovative high-tech production system was installed and started-up to produce and deliver high value fillers for the automobile industry. Advantage of the system is an improvement of the quality because of:

- · Shorter and faster processing times
- · Homogeneity from the additive to the coloured paste
- High flexibility (batch sizes from 5 to 40 t)
- · Implementation of slurries and liquid semi-products
- · Optimised availability of the system due to PLC controlled service and maintenance

Improvement of the environmental protection because of:

- · Reduction from vapour and solvent emissions due to a closed svstem
- Reduction of noise emissions
- Improvement of the hygienic condition for workers

The technical features for such a system are:

- Modular set-up of the facility
- Rotor-Stator-Dispersing technology
- Jetstream mixing technology
- PLC Control system
- Dosing of liquid raw materials (slurry, coloured paste, semiproducts)
- · High efficient bead mill with an extremely high flow rate
- Online silo emptying, no storage silo required
- Handling of the process in a completely closed system

able to weigh in 40 tons of material with an accuracy of 1 kg.

Existing systems require a special company for cleaning the same, for the new system simply a special cleaning module is attached (Picture 8). The spraying nozzle is designed to reach all corners of the mixing vessels.

Transposition to semi-products in the industry for raw materials

In a long term, the new system is designed for the handling of liquid materials. In the United States the technology for handling slurries is for more widespread compared to Europe. To achieve a better economy for the cost for the production of slurries, the production should be more and more transposed to semiproducts that already provide several functions.

In case the concept to handle more and more liquid semi-products will be accepted by other manufacturers of lacquer and paint, this would have an enormous influence on the suppliers for raw materials. The flexibility of the suppliers for raw materials will increase dramatically when they offer semiproducts as they no longer will have to supply an exactly determined raw material but – independent from the defined components – a product with a defined function. In near future such a paradigm could be imminent.

Courage to take the risk

The modular high tech manufacturing of lacquer and paint was the largest investment in the history of Hemmelrath. The decision to go for this step arose from the quest for a leading technology and quality and could be the initiator for a new trend in this technology.

Only with this particular willingness to leave well know paths and to accept an amortisation time longer than nowadays calculation we will be able to start with a real innovation and to set new quality standards – prerequisite to ensure a long term business for a mid sized facility located in Germany.



Picture 11 The Hemmelrath facility in Klingenberg is foreseen to be the main production facility for fillers

Hemmelrath nowadays is considered market leader in the field of automomobile hydro fillers. Target is to be a complete supplier for automobile lacquer. Klingenberg is going to be the location for the modular production of fillers (Picture 11). The second production facility in Eisenfeld-Rück in about 10 km distance will be modified to produce the basic lacquer. The third facility in Obernburg already started the production of clear lacquer in autumn 2005.



