



## **WEIMAR TECHNOLOGY CENTER**

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**PARTICLE DESIGN AND PARTICLE ENGINEERING**

**APPTec POWDER SYNTHESIS – FLUIDIZED BED – SPOUTED BED**



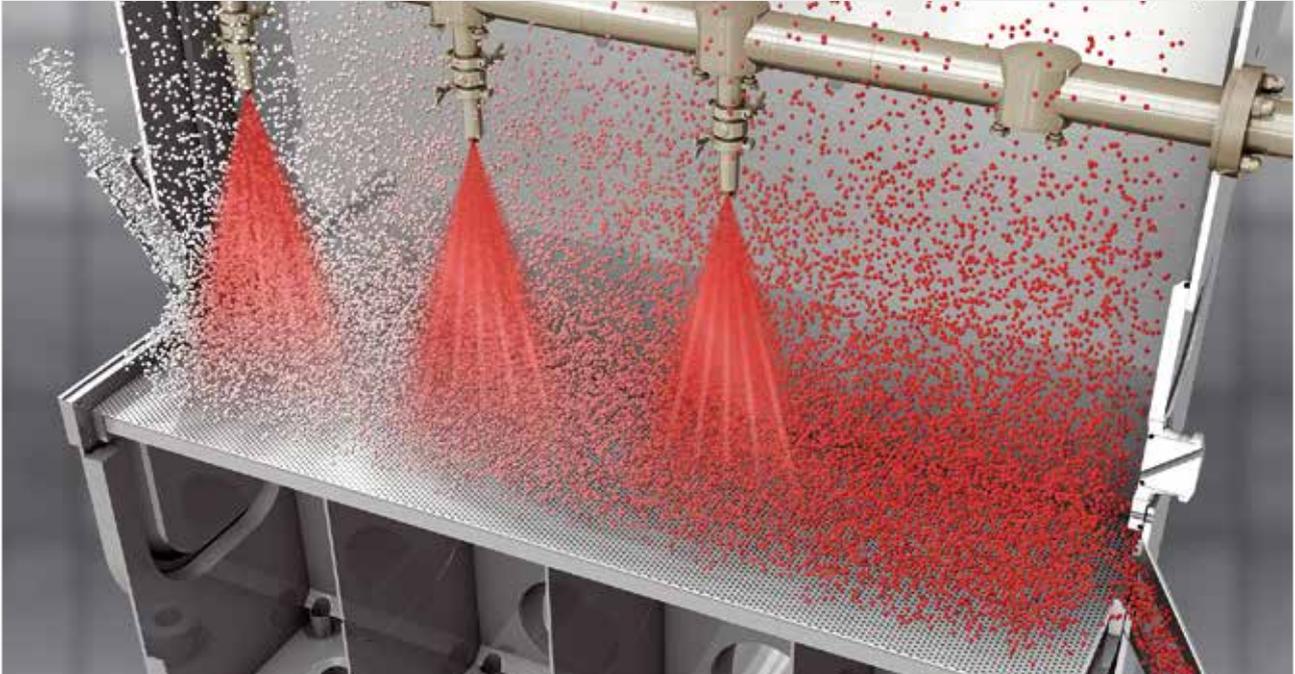
## A FACILITY WITH UNRIVALED ACCESS TO EQUIPMENT

	ProAPP reactor	Mini / Midi Glatt	ProCell LabSystem	AGT PilotSystem	ProCell PilotSystem	GVW
<b>Focus</b>						
Feasibility studies	●	●	●	–	–	–
Product development	●	●	●	–	–	–
Process development/optimization	●	–	–	●	●	●
Sample production	●	–	●	●	●	●
Scale-up	●	–	–	●	●	–
Contract manufacturing	●	–	●	–	–	●
<b>Technology</b>						
APPtec®	●	–	–	–	–	–
Spouted bed	–	–	●	–	●	●
Fluidized bed	–	●	●	●	●	●
Rotor	–	–	●	–	–	–
<b>Process</b>						
Powder synthesis	●	–	–	–	–	–
Core-shell particle coating	●	–	●	–	–	–
Spray granulation	–	–	●	●	●	●
Spray agglomeration	–	●	●	●	●	●
Spray coating	–	●	●	●	●	●
Spray encapsulation	–	–	●	●	●	●
Pelletizing/powder coating	–	–	●	–	–	–
<b>Operating mode</b>						
Continuous	●	–	●	●	●	●
Batch	–	●	●	●	(●)	●
<b>Product volumes</b> <sup>*1</sup>	5 kg - 300 t	0.1 - 5 kg	1 - 50 kg	50 - 1,000 kg	50 - 1,000 kg	200 kg - 20 t
<b>Product</b>						
Grain sizes	20 nm - 100 µm	0.1 - 3 mm	0.1 - 5 mm	0.1 - 5 mm	0.1 - 3 mm	0.1 - 5 mm
Product temperature	200 - 800 °C	max. 60 °C	max. 150 °C	max. 180 °C	max. 180 °C	max. 80 °C
<b>Performance</b>						
Product throughput	1 - 80 kg/h	0.1 - 2 g/batch	0.5 - 30 kg/batch 0.2 - 15 kg/h	10 - 150 kg/batch 5 - 50 kg/h	– 5 - 30 kg/h	100 <sup>*2</sup> - 380 kg/batch 5 - 30 kg/h
Spray rate	10 - 160 kg/h	1 - 10 g/min	0.2 - 18 l/h	5 - 100 l/h	5 - 75 l/h	20 - 250 l/h
Effective volume	–	5 <sup>2</sup> - 2,320 ml	0.4 - 38 l	10 - 300 l	20 - 100 l	150 - 640 l
Inlet air temperature	200 - 900 °C	max. 80 °C	max. 300 °C	max. 200 °C	max. 350 °C	max. 135 °C
Outlet air temperature	200 - 800 °C	max. 60 °C	max. 120 °C	max. 180 °C	max. 180 °C	max. 80 °C
Air volume	250 - 1,000 Nm <sup>3</sup> /h	100 m <sup>3</sup> /h	2 systems 250 m <sup>3</sup> /h 2 systems 500 m <sup>3</sup> /h	400 - 2,000 m <sup>3</sup> /h	400 - 2,600 m <sup>3</sup> /h	1,000 - 4,000 m <sup>3</sup> /h
Air speed	0.3 - 15 m/s	0.2 - 1.5 m/s	0.5 - 5 m/s	0.5 - 4 m/s	0.5 - 3 m/s	0.5 - 1.5 m/s
Bottom spray	●	●	●	●	●	●
Top spray	–	●	●	●	●	●
Tangential spray	–	–	● (rotor only)	–	–	–
<b>Extras</b>						
Processing of all St-1/St-2 dust	● <sup>*2</sup>	●	●	●	●	●
Processing of solvents	● <sup>*2</sup>	●	●	–	●	●
<b>Modular design</b>						
Process inserts for small-volume production <sup>*1</sup>		Mini-Glatt Micro-Kit <sup>*2</sup> Mini-Glatt, Midi-Glatt	AGT 2, ProCell 5, Vario 3, Rotor 7			
Process inserts for sample production and subcontracting <sup>*1</sup>			GF 5, Vario 7	AGT 12, Vario 25	ProCell 25, GF 25	ProCell 50, WSG 200, 32" Wurster

\*1 depending on product

\*2 on request

## MORE PERFORMANCE FOR YOUR PRODUCT



With our innovative technologies, the possibilities are practically endless. The key to the ideal product is choosing the right process parameters, along with the multitude of combination options for these parameters.

### *APPtect® – a unique Advanced Pulse Powder technology for tailored particle design.*

Glatt has redefined the continuous process for powder synthesis. Thanks to its very specific thermodynamic conditions, this outstanding process is able to synthesize innovative, high-performance materials with previously non-existent combinations of properties. The chemical composition of the particles created can largely be freely configured.

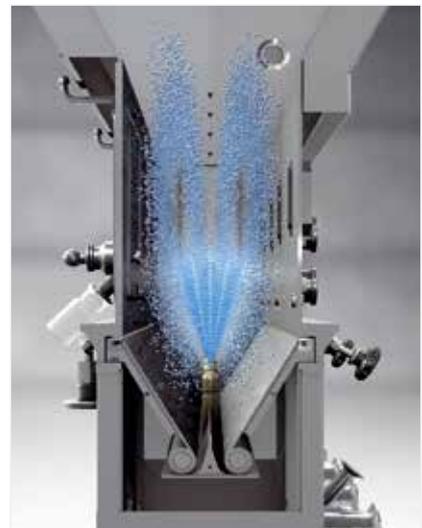
### *Fluidized bed – ideal for custom particle engineering with granulation and coating*

In addition to the thermal treatment of solid materials, fluidized-bed processes are used for drying tasks, for forming granulates from powders or liquids, and for the coating of particles.



### *Spouted bed – effective granulation and coating processes for special requirements*

This technology delivers significantly higher heat and material transfer rates. This makes it possible to refine very small, very large, or irregular products, as well as process sensitive products at short retention times. The adjustable energy input also makes the processes very economical.



# UNIQUE PLATFORM FOR PARTICLE DESIGN AND ENGINEERING

*Find solutions for tomorrow today.*

With this forward-looking center of technology, Glatt has created an attractive platform for experts, developers, manufacturers, and scientists. With their innovative technologies for the manufacturing of granulates and pellets from powder or liquids containing solids, our competence centers offer you the possibility to develop new types of product forms using feasibility tests or, using testing, to enhance the properties or manufacturing process of already established products. Equipment and systems of varying sizes – from laboratory to pilot to industrial scale – are available to you for these studies.

***Do you have a product idea? Take advantage of our technology and our expertise on site.***

*The network for research and development*

Our technology center in Weimar is working in conjunction with renowned scientific organizations such as universities and research institutes in Germany and abroad. This is where powders and liquids are refined to granules and pellets. Thanks to continuous research and development in process engineering, our systems are now able to optimize products that could hardly be processed even just a few years ago. We offer our international customers from diverse industries access to innovative technologies for their processes.

***Solutions for your edge in the market. That is our daily challenge. Take advantage of our experience!***

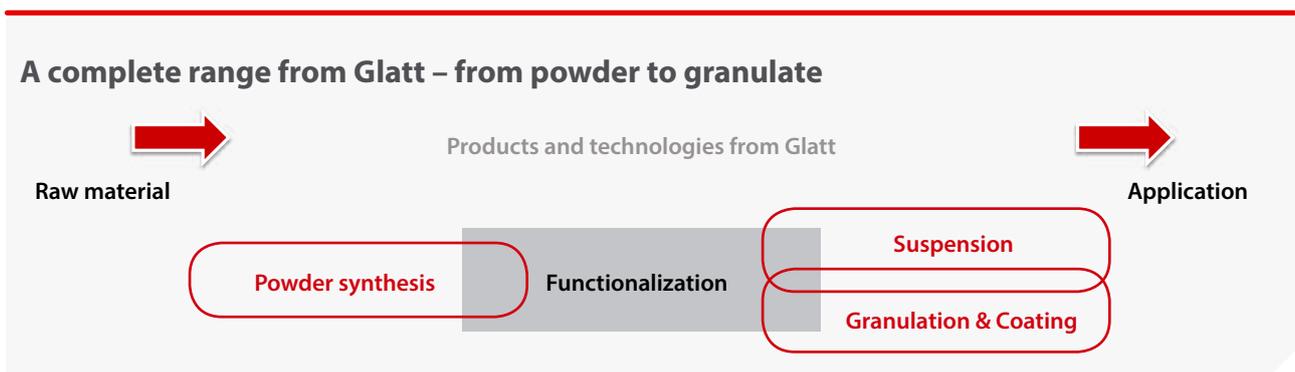
## Services

Developing optimal technology processes for manufacturing high-quality granulates is the focus of our activities. Our expert team of highly qualified engineers from various areas of expertise and experienced technicians work closely together with specialists from your company to develop groundbreaking solutions to help your success.

## Equipment

The combination of a large variety of processes and the latest device technology enables traditional and customer-specific applications of the most diverse of processes. We have a broad range of innovative fluidized bed and spouted bed systems available for you. Additional devices like extruder, pelletizer, tablet press, in addition to modern analytics round off the offer.

***For structuring and processing your products of tomorrow. All according to your needs.***



## OUR SERVICES

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### *Feasibility tests*

We offer you the opportunity to test your product in terms of technical feasibility and to optimize the process according to your specific requirements.

Various processes, extensive process expertise, and state-of-the-art systems are available to you for the innovative development of your products.

We use our technical expertise to adapt existing processes and systems to the specific needs of your product. You benefit from a maximum level of flexibility so your product will be ready for marketing faster.

### *Product optimization*

You can benefit from our experience in product optimization. We improve the properties and manufacturing processes of your established products in cooperation with you through systematic experimental analysis.

From laboratory scale to production maturity, your manufacturing process is optimized and tested step by step.

Our extensive experience in this area, as well as experience as a contract manufacturer with a wide range of products and processes, ensure the optimal use of the technical possibilities.

### *Process development*

Develop your customized processes for customized products with us. With comprehensive scale-up measures, we can design your manufacturing process for the production of large volumes to suit your needs exactly.

The reliable scale-up from laboratory to production scale for guaranteed product properties requires reliable tests of high-performance pilot systems. Here, technical configurations are tested, stability tests are conducted, and all relevant parameters for designing production processes are determined.



### *Product sample manufacturing*

Are you looking for a reliable partner to manufacture small amounts of marketing samples? We would be happy to take over the production for you.

Quickly. Effectively. According to your specific requirements.

For the production of product samples, we have multifunctional laboratory equipment with larger process inserts as well as flexible pilot systems and a modern production facility available to you in our technology center.

Take advantage of our innovative technologies for your marketing samples!

### *Contract development*

Our group of companies offers a uniquely broad range of processes, devices and systems. A comprehensive platform for customer- and application-specific development processes.

When partnering with Glatt for your development project, you have the entire potential of our versatile powder synthesis, granulation, and coating techniques at your disposal.

To do so, our team of experts uses the most modern methods in the development of processes, technical solutions, or special applications.

And of course, the company is also committed to maintaining the strictest confidentiality.

### *Training*

Would you like an overview of our technologies or to get to know them in detail?

You can benefit from the knowledge and experience of our processing experts in our professional seminars and workshops. In theory and in practice. At our place or yours.

We provide training on the principles of the processing technology and application-specific processes. We instruct operators and introduce them to the possibilities of our lab equipment and how to use it.

On request, we also organize special training courses.

## CONTRACT MANUFACTURING



### *We manufacture on your behalf!*

Is your production capacity maxed out? Do you want to use the time until starting your own production in a different way? Or is in-house production out of the question?

We are perfectly equipped for the special requirements in the areas of food, feed, and fine chemicals. Our modern equipment and our many years of experience guarantee the highest quality – even for the most demanding requirements.

The Glatt machine service ensures high availability of production facilities and quick adaptation of the processes

to the different tasks. You are on the safe side thanks to our certification according to ISO 9001: 2015 for the entire company at the Weimar site and thanks to an established HACCP system for our subcontracting area.

Rely on our comprehensive service portfolio for subcontracting:

- » Innovative powder synthesis based on APPtec®
- » All traditional fluidized bed batch processes and continuous spray granulation
- » Scale-up for easy transfer of laboratory results to production scale
- » Recipe-driven process control

- » Process documentation of all batches for traceability and quality control
- » In-process control – quality monitoring in our own analytics laboratory
- » End-to-end logistics from raw materials procurement to shipment, including environmentally sound disposal of waste

## QUALITY ASSURANCE

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*Our commitment: Premium services for your customer satisfaction.*

This is why we also set strict quality assurance standards. All procedures are certified according to ISO.

In addition, our production is subject to official control via the food manufacturing permit.

Our quality maxims – the key to your satisfaction:

- » During the inspection of incoming goods, we verify your raw materials for transport damage and retained samples.
- » In-process control, final inspection, and approval are carried out according to specification.
- » We provide reliable documentation of the processes for batch-accurate traceability of your products.
- » Numerous devices are available in our modern analytical laboratory to ensure the quality of raw materials and manufactured products according to specification.

- » We provide analytical services too, even without further use of our technology center.
- » We train our employees continuously in process management and hygiene.

## WORKING HAND-IN-HAND WITH GLATT

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### *Communication is essential*

Instant products, spices, flavors  
Sweeteners, preservatives, enzymes,  
stabilizers, texture agents, vitamins,  
microorganisms, essential oils, salts,  
bleach, ceramic or catalytic powders,  
pigments, polymers, diamonds for tool  
coatings, and many others – the more  
diverse the range of applications, the  
more varied the tasks to be performed.  
Tell us as soon as possible which  
properties your raw materials have and  
which ones are on the wish-list for your  
desired end products. Safety-related  
conditions, such as product safety  
as well as personal and explosion  
protection, are just as important in this

early project phase as the plans for  
the subsequent production regime,  
product change frequency, production  
volumes, budgeting, and location. Are  
you required to observe specific manu-  
facturer documentation? Is there a  
need for qualification services?

Detailed questionnaires are used  
to support this process, since the  
answers to all of these questions will  
help to align the experimental testing  
procedures perfectly to subsequent  
production requirements.

### *Transparency as our top priority*

The experiments will be conducted by a  
Glatt in-house team of process engineers  
who are specialized in the applications in  
question. In the laboratory, the manufac-  
tured samples will be thoroughly tested  
during the test implementation itself so  
that conclusions can be drawn regarding  
the ongoing development work. And  
here's where you can get involved too!  
Depending on the specific intermediate  
results, you can have a direct influence  
on the testing procedure. All tests are  
documented in detail and provided in  
the form of a report, allowing you to  
maintain full transparency at all times.

## POWDER SYNTHESIS – FROM THE LAB TO PRODUCTION



### *From the initial idea to full-scale mass production*

Our scientific and engineering expertise form the basis for successful development and is fully at your disposal.

Our laboratory offers numerous analytical and experimental options for basic and screening tests, as well as determining causal relationships and influential parameters. It is the guarantor of quality assurance and certification.

Our high-performance technology center enables pilot-scale technical tests in addition to test production processes.

At this stage, the appropriate process parameters are determined, the process ideally configured, or samples for application trials generated – including on a multi-ton scale if requested.

Our contract manufacturing systems offer enough capacity for the production of your specific choice of materials. This means that you are able to instantly supply to your customers and secure a key share of the market.

### *ProAPP synthesis reactor*

The APPtec® synthesis reactor is equipped with a specially designed combustion chamber. It is available in various system sizes for material development or contract manufacturing – including on a multi-ton scale as required.

- » Homogeneous process temperature between 200 °C and 900 °C
- » Homogeneous and adjustable retention time from 100 ms to 10 s
- » Configurable gas atmosphere, oxidizing or O<sub>2</sub>-free
- » Raw material: Solutions, suspensions, or solids

## LABORATORY SCALE FOR GRANULATION AND COATING

*You determine the best manufacturing process for your product with us!*

We carry out feasibility tests on a small scale, with product volumes from a few grams up to a few kilograms. At multi-functional laboratory facilities, we develop new product formulas or optimize the properties and manufacturing processes of already established products in experimental trials. Efficient and an exact fit for your individual requirements.

The modular design of our lab systems allows us to quickly and effectively respond to changing demands. Your process can be continuous or by the batch! Try out different spraying systems or different options for exhaust air cleaning. Processing solvents is possible just as much as processing all St-1 and St-2 powders. Your specific area of application can be expanded individually through the flexible use of ancillary equipment.

Do you prefer to experiment in your own production environment? No problem! All our lab equipment is mobile and can be rented.



### *Mini / Midi-Glatt*

Our classic lines for all batch-wise fluidized-bed processes.

Test out agglomeration, drying, and coating processes with the top-spray, bottom-spray, and Wurster methods!

Just the way you need it.

- » Interface for connecting an external data recorder
- » Interchangeable work towers
- » Mini-Glatt for batch sizes of 200 ml and above
- » Mini-Glatt with Micro-Kit upgrade for batch sizes from 5 to 100 ml
- » Midi-Glatt for batch sizes from 580 to 2,320 ml
- » Fluidization by means of compressed air or nitrogen
- » Integrated metal cartridge filter
- » Suitable for working with solvents



### *ProCell Lab System*

We have five modular all-rounder systems available for feasibility tests with your product. For all processing options, whether fluidized bed, spray coating, or rotor processes.

For continuous or batch-wise operation, using the top-spray, bottom-spray, tangential-spray, and Wurster methods.

Process inserts:

AGT 2, ProCell 5, Vario 3, Vario 7, GF 5, Rotor 7

Giving access to the maximum in flexibility.

- » Fresh air / Air recycling mode
- » Circulation mode: Air or nitrogen
- » Processing of all St-1 / St-2 dust
- » Processing of solvents
- » Solvent recovery
- » WIP version
- » PRO version (Ex pressure-resistant)
- » Melt spray system
- » 3-fluid-nozzles
- » Dehumidification of inlet air
- » Internal cartridge or bag filter
- » External cyclone and dust recirculation
- » External cartridge filter
- » Continuous solid materials feeder
- » Zig-zag sifter for continuous, classifying product outlet
- » Recipe control
- » Data storage
- » Siemens S7 control
- » Visualization: Win CC

## PILOT SCALE FOR GRANULATION AND COATING

*You determine the optimal processing parameters for your product with us!*

To make valid and safe transfers from laboratory scale to a production scale, small-scale tests on high-performing pilot systems are needed. We have several pilot systems of different builds available to configure to your specific application.

Different process inserts, filter and spray systems, various cleaning concepts as well as the addition of more processing steps such as sieving, extrusion, pelletizing, or tablet pressing give you maximum flexibility. Continuous processes are the main focus. Batch processing is available too, if needed.



### *AGT PilotSystem*

Our modular system with maximum process flexibility for process development, process optimization, and scale-up for continuous and batch fluidized bed processes allows diverse processing options.

Process inserts: AGT 12, Vario 25

- » Fresh air / Air recycling mode
- » Sieving / Grinding circulation
- » Explosion suppression system
- » Top spray or bottom spray
- » Melt spray system
- » 3-fluid-nozzles
- » Continuous solid materials feeder
- » Continuous, volumetric product outlet
- » Processing of all St-1 / St-2 dust
- » Internal bag filter
- » External cyclone and dust recirculation
- » External bag filter
- » Data storage
- » Siemens S7 control
- » Visualization: Win CC



### *ProCell PilotSystem*

Our modular plant system features high flexibility in terms of process development, process optimization, and scaling up for continuous fluidized or spouted bed processes with a variety of process options.

Process inserts: ProCell 25, GF 25

- » Fresh air / Air recycling mode
- » Closed loop: Air or nitrogen
- » Solvent recovery
- » Sieving / Grinding circulation
- » WIP version
- » Explosion suppression system
- » Top spray or bottom spray
- » Melt spray system
- » 3-fluid-nozzles
- » Dehumidification of inlet air
- » Continuous solid materials feeder
- » Continuous, volumetric product outlet
- » Internal cartridge, plate, or bag filter
- » External cyclone and dust recirculation
- » External cartridge filter
- » Recipe control
- » Data storage
- » Siemens S7 control
- » Visualization: Glatt MegaView

## PRODUCTION SCALE FOR GRANULATION AND COATING

*Our modular system concept gives you a wide variety of processing options.*

A modular, large-scale plant is available for initial production campaigns as well as for long-term contract manufacture. All fluidized bed batch processes and continuous spray granulation can be carried out here.

Our modular system concept focuses on batch fluidized bed processes, such as coating and agglomeration. Continuous processing is available too, if needed. Our plant is approved for aqueous systems as well as organic solvents. For your specific application.



### *Glatt GVW fluidized bed system*

Our multi-optional system for process development, process optimization, scale-up, and contract manufacturing with continuous and batch fluidized bed and spray coating processes: a multi-talent for diverse applications.

Effective volume: 150 - 640 l

Process inserts:

ProCell 50, WSG 200, 32" Wurster

- » Fresh air / Air recycling mode
- » Closed loop: Vacuum
- » Closed loop: Air or nitrogen
- » Solvent recovery
- » Sieving / Grinding circulation
- » Top spray or bottom spray
- » Melt spray system
- » Dehumidification of inlet air
- » Continuous solid materials feeder
- » Continuous product outlet
- » Internal bag filter
- » Trend memory for data storage
- » Siemens S7 control
- » Visualization: Win CC

## COMPLEMENTARY TECHNOLOGIES

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Fette 102i tablet press

### *The complete range*

A successful product design requires a holistic approach to the development process. Depending on the nature of the application profile, it may be useful to link up different processes in an intelligent way. This also relies on the coordination of individual stages. For this reason, even complementary technologies can be tested and integrated into fluidized and spouted bed applications. We provide complementary equipment, e.g., for wet mixing (high shear), granulating, sieving, grinding, extruding, pelletizing, and pressing into tablets.



Laboratory pelletizer P 50



Laboratory extruder GBE 200



Table mixer / granulator TMG

## PREPARATION OF RAW MATERIALS OR PRODUCTS



Inline disperser

### *Mixing. Dispersing. Dissolving. Suspending. Homogenizing.*

Fluids often have to be produced or treated in a special way. To this end, the technology center has a wide range of equipment available. This includes various mixing systems, dispersers, or homogenizers.

Fluids containers are also available in a range of sizes. The temperature of these containers can be regulated so that even saturated solutions or melts can be processed. Of course, we can also cater to your specific requirements, developing special solutions as needed or integrating additional equipment.

In addition to the production of raw-material solutions, suspensions, emulsions, dispersions, or melts as a preliminary stage prior to further processing in our fluidized and spouted bed systems, the conveyance of fine-scale powder systems which have been generated using APPTec® is of course available in fluid-based products (e.g., suspensions).



Jet stream mixer

## LOANER / RENTED SYSTEMS

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### *Glatt equipment in your laboratory*

Do you want to develop the products in your company or optimize and test appropriate processes locally? Glatt provides laboratory facilities as loaners on a temporary basis.

You can sit back and relax: we make sure that the delivery, set-up, commissioning, and pick-up of the system

is on time.

Our technicians will give you extensive instructions to make sure you can take advantage of all system options. Of course we will be available with help and advice during the rental period.

Use our laboratory devices for individual tests in your company!

Devices for rental:

- » ProCell LabSystem standard design, fluidized bed and spouted bed laboratory system (continuous / batch)
- » ProCell LabSystem PRO version
- » Pelletizer P 50
- » Basket extruder GBE 200
- » Mini-Glatt / Midi-Glatt batch fluidized bed laboratory unit
- » Accessories such as dehumidifiers, hot-melt modules

Other devices on request.

## ANALYTICS

### *Monitoring our processes with modern analytics*

It is important to ensure the right mix not only for your products, but when it comes to our analytics as well.

That is why we combine modern analyzing units for focused, specialized granulate and powder analytics with your methods and product-based specifications.

Our analyses are indispensable for process monitoring (IPC) and process control in particular as well as for upcoming plant planning.

Alongside existing and established methods, your own analysis techniques and methods can also be adapted if necessary. Feel free to contact us.



### *Extract from our analytics portfolio*

- » Particle size distribution (photo-optically / via laser diffraction and dynamic light scattering or sieving analysis)
- » Particle shape and shape distribution (image analysis)
- » Moisture content (via halogen, infrared, or ceramic radiator or, alternatively, in the drying oven)
- » Microscopy
- » Bulk density (according to ISO)
- » pH value and electrical conductivity
- » Phase analysis via X-ray powder diffraction (XRPD)
- » Liquid rheology, viscosity
- » Pore size distribution (according to BJH among other methods) and specific surface area (generally according to BET) via nitrogen adsorption
- » Volumetric titration (acid / base, redox, water according to Karl Fischer)
- » Element analytics via ICP-OES
- » Elemental analysis (currently C, H, N, S)
- » Vapor or solvent sorption/desorption (DVS)
- » Thermal analysis (DSC / TGA)
- » Residue on ignition (muffle furnace)



## EXCELLENT INFRASTRUCTURE

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Glatt's technology hub, located in the German city of Weimar, is integrated into a brilliantly sophisticated local infrastructure network – from the delivery of raw materials to the provision of end products.



Benefit from a high-performance concept developed from expert know-how, technology transfer, flexible process and site conditions, and an excellent, comprehensive level of service.

Moreover, when visiting us, you can spend your free time enjoying the diverse offering of the cultural capital of Weimar.



[www.glatt.com](http://www.glatt.com)

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