



**Integrated Process Solutions.**

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Granulation & Agglomeration Seminar 2016, 25th October, Rotterdam



## Innovations in Fluidized Bed Granulation Technology

Ursula Litzke, Glatt Ingenieurtechnik Weimar



# Presentation Overview

Company History/ structure

Processing Options with fluid bed

Batch / Continuous Operation Overview

Fluid Bed / Spouted Bed Technology

Laboratory Unit ProCell LabSystem

Application Examples



# Glatt History Worldwide



- 1954** company foundation
- 1959** delivery of the first fluid bed dryer for the pharmaceutical industry
- 1961** move to Binzen and attend first time on ACHEMA
- 1964-66** development fluid bed granulation
- 1970** introduction of Wurstercoatingprocess
- 1971** foundation Glatt AG Pratteln (CH)
- 1972** foundation Glatt Air Techniques (USA)
- 1981** delivery of the first granulation line
- 1981** foundation offices in DK, F, UK
- 1983** delivery first continuous fluid bed unit
- 1991** foundation GIT (Weimar) + GST (Dresden) extension in FFF application
- today** international group with 2000 employees worldwide



# International Glatt Group Organization and Structure



Pharmaceutical Services



Process Technology Pharma



Process & Plant Engineering



Process Technology FFF

Pharmaceutical Industry

+ Biotechnology

Food, Feed & Fine Chemical Industry

Product  
Development  
Contract  
Manufacturing

Process  
Technology

Process and  
Plant Engineering  
Validation  
Qualification

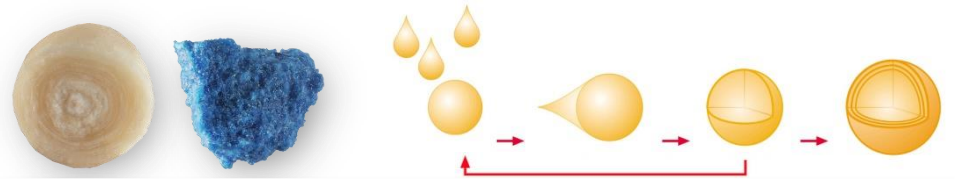
Particle Design  
Process  
Technology  
Contract  
Manufacturing



# Fluid Bed Technologies - Process Options

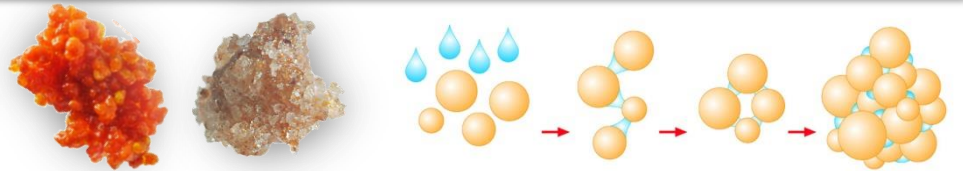
## spray granulation

granules and pellets from liquids



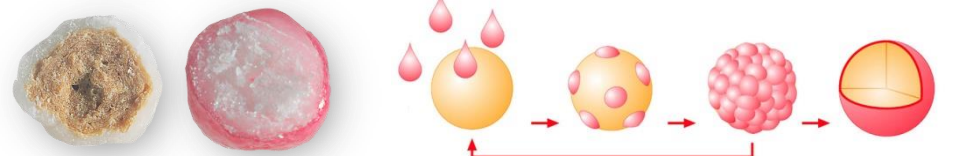
## agglomeration

granules from powder



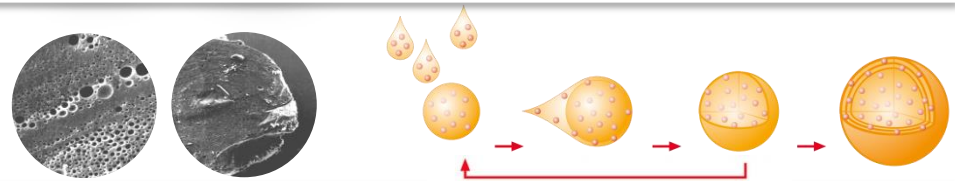
## coating

encapsulation of particles with liquids



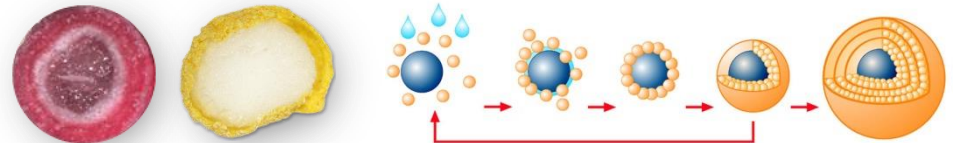
## encapsulation

(micro-)encapsulation of liquids



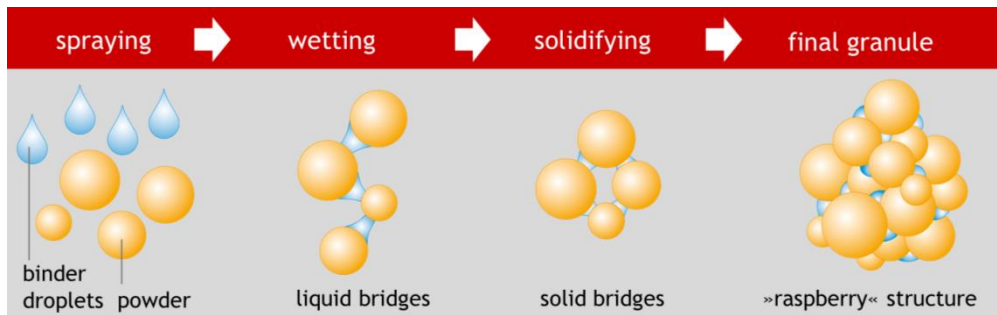
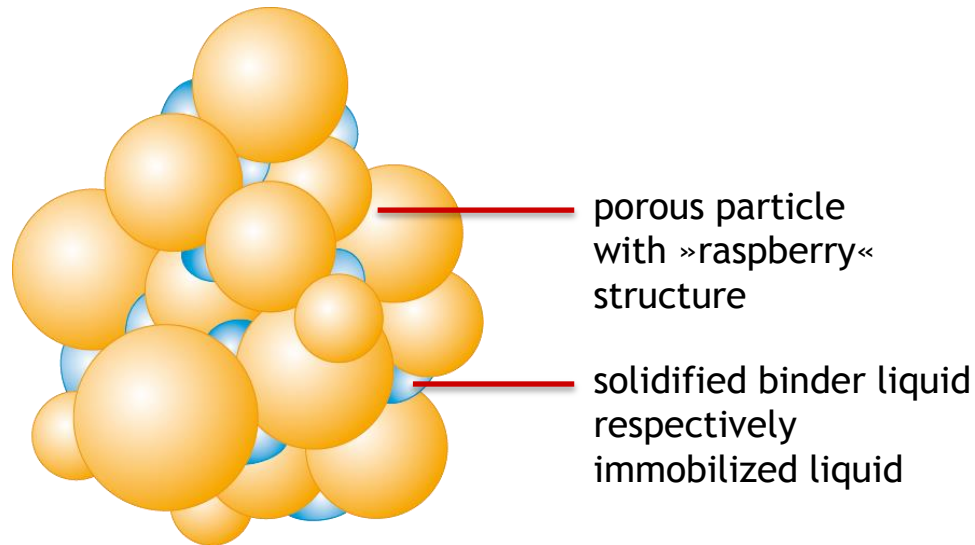
## powder layering

encapsulation of particles with powder





# Agglomeration of Powder



## WHAT OF?

- » of powders
- » immobilization of liquids

## WHERE?

- » in the fluidized bed
- » rotor
- » high shear mixer

## WHEREBY?

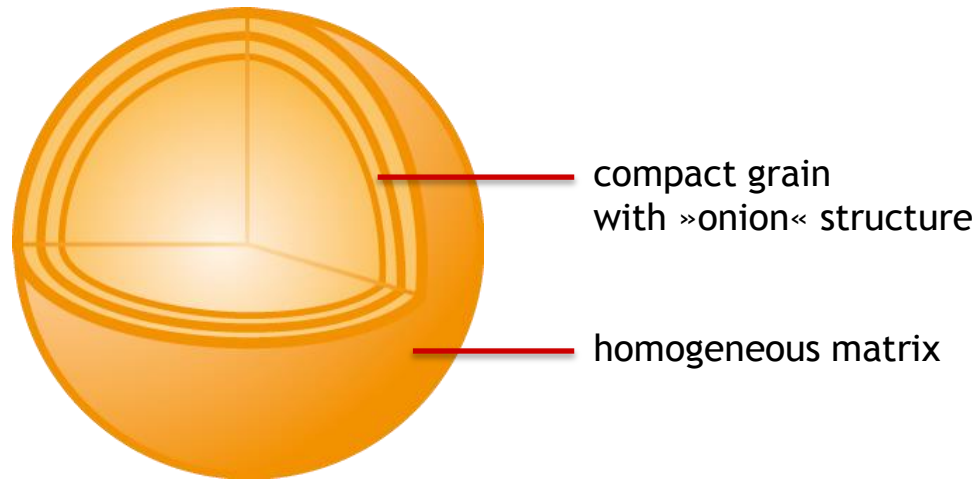
- » by top spray
- » by bottom spray
- » by tangential spray (rotor)

## WHEREWITH?

- » solutions (binder)
- » suspensions (binder)
- » emulsions (binder)



# Spray Granulation of Liquids



## WHAT OF?

- >> spray granulation of liquids
- >> encapsulation of liquids

## WHERE?

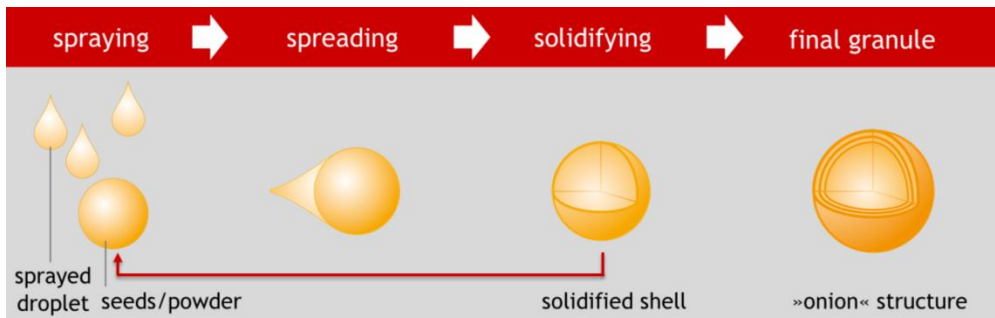
- >> in the fluidized bed

## WHEREBY?

- >> by top spray
- >> by bottom spray

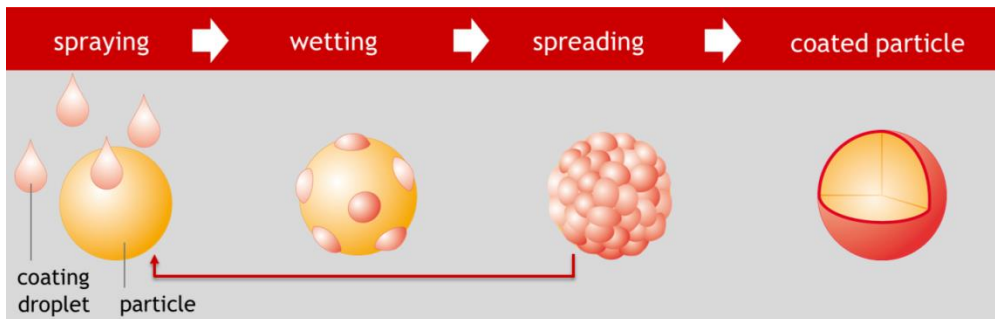
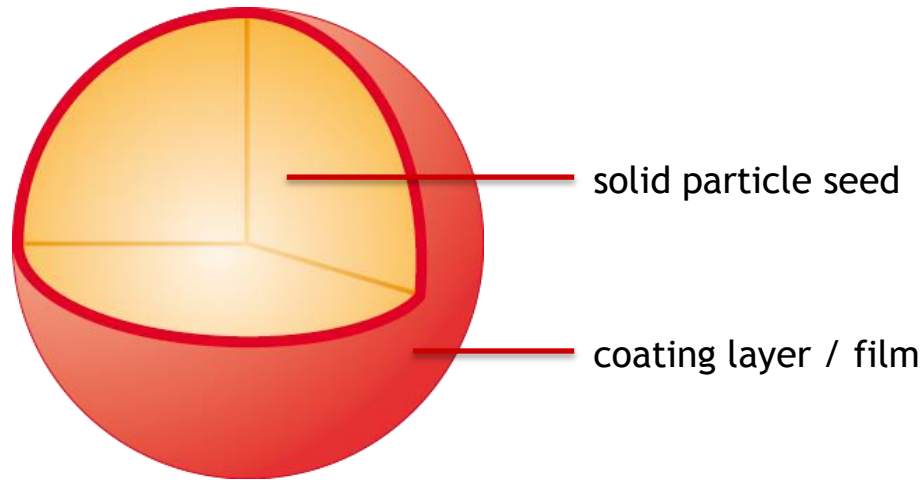
## WHEREWITH ?

- >> solutions
- >> suspensions
- >> emulsions
- >> melts





# Coating - Encapsulation of Particles with Liquids



## WHAT OF?

- » encapsulation of particles with liquids

## WHERE?

- » in the fluidized bed
- » drum (pan) coated

## WHEREBY?

- » by top spray
- » by bottom spray
- » by Wurster



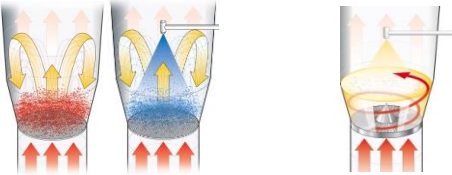


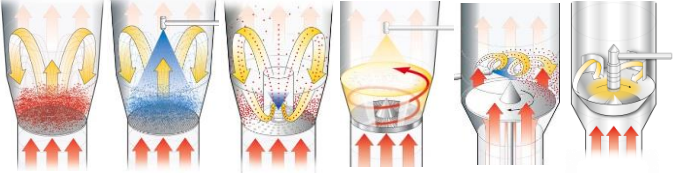


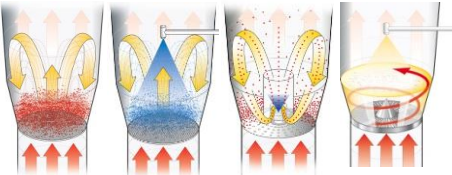
## WHEREWITH?

- » solutions
- » suspensions
- » emulsions
- » melts





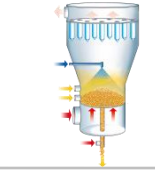



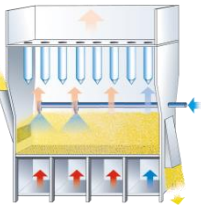


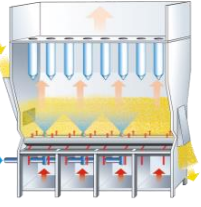
# Batch Fluid Bed Technologies

## Types of Equipment

Type	Process Option	Lab Scale	Production	Principle
<b>WSG</b>	<p>Agglomeration top spray / HP spray</p> <p>Drying</p>			
<b>GPCG</b>	<p>Agglomeration top / tangential / HP spray</p> <p>Coating top / bottom / HP spray</p> <p>Pelletizing tangential spray / CPS</p> <p>Drying</p>			
<b>WS Combo</b>	<p>Agglomeration top / bottom / HP spray</p> <p>Coating top / HP spray</p> <p>Drying</p>			

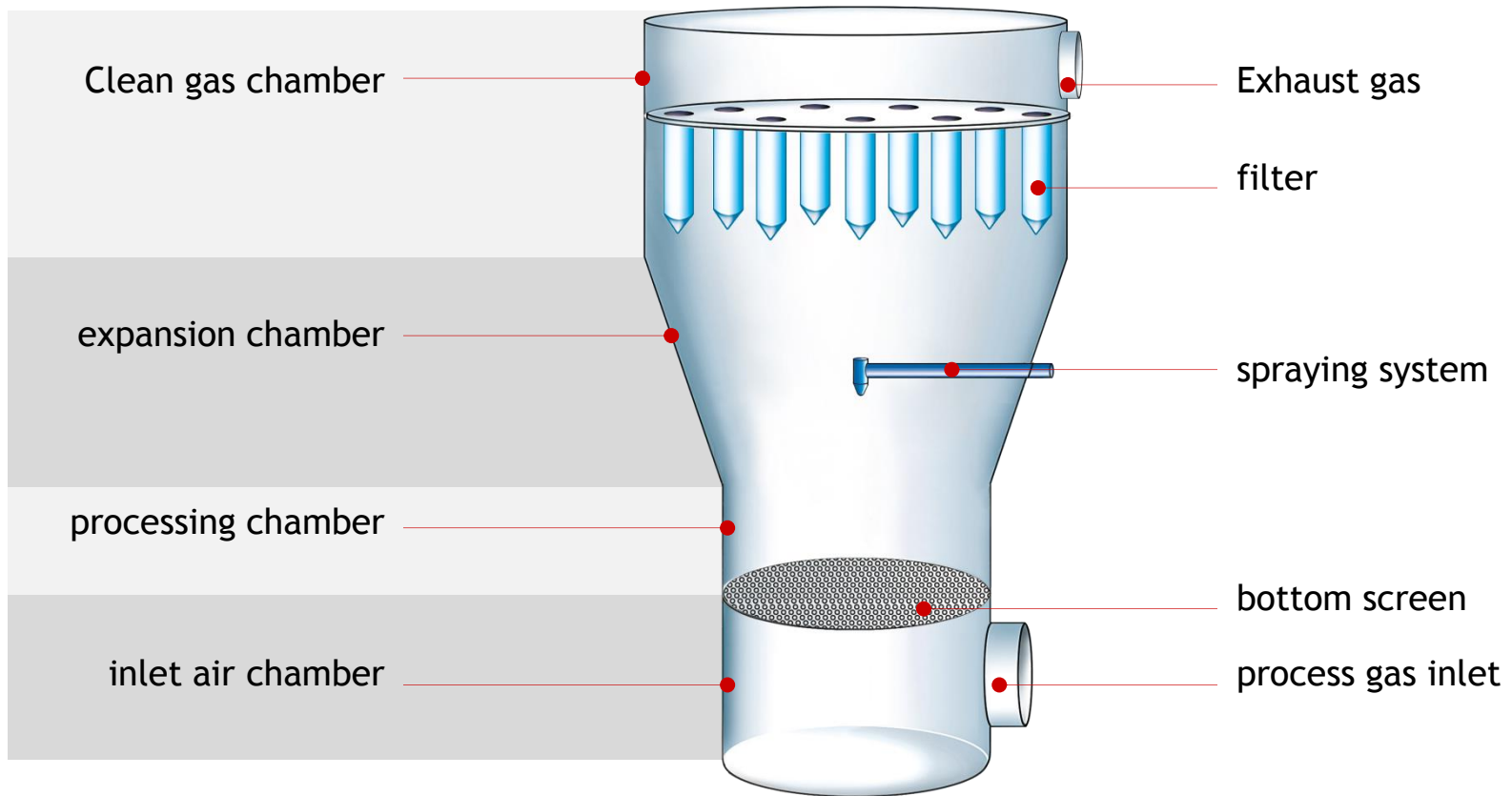


# Continuous Technologies Types of Equipment

Type	Process Option	Lab Scale	Pilot Scale	Production Scale	Principle
<b>AGT</b>	fluid bed spray granulation top / bottom spray				
<b>GF</b>	fluid bed spray granulation top / bottom spray agglomeration top / bottom spray coating top / bottom spray drying				
<b>ProCell</b>	spouted bed spray granulation top / bottom spray agglomeration top / bottom spray drying				



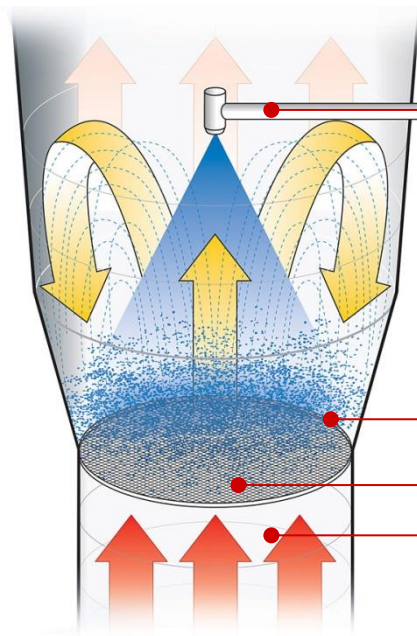
# Fluid Bed Technology - Main Parts of **Batch** Units





# Fluid Bed Technology

Process Option	Operation Mode	Fluid Bed Equipment
agglomeration, particle coating, drying	batch	WSG, WS Combo, GPCG with top spray insert



filter housing  
top spray system

processing chamber/product vessel

bottom screen

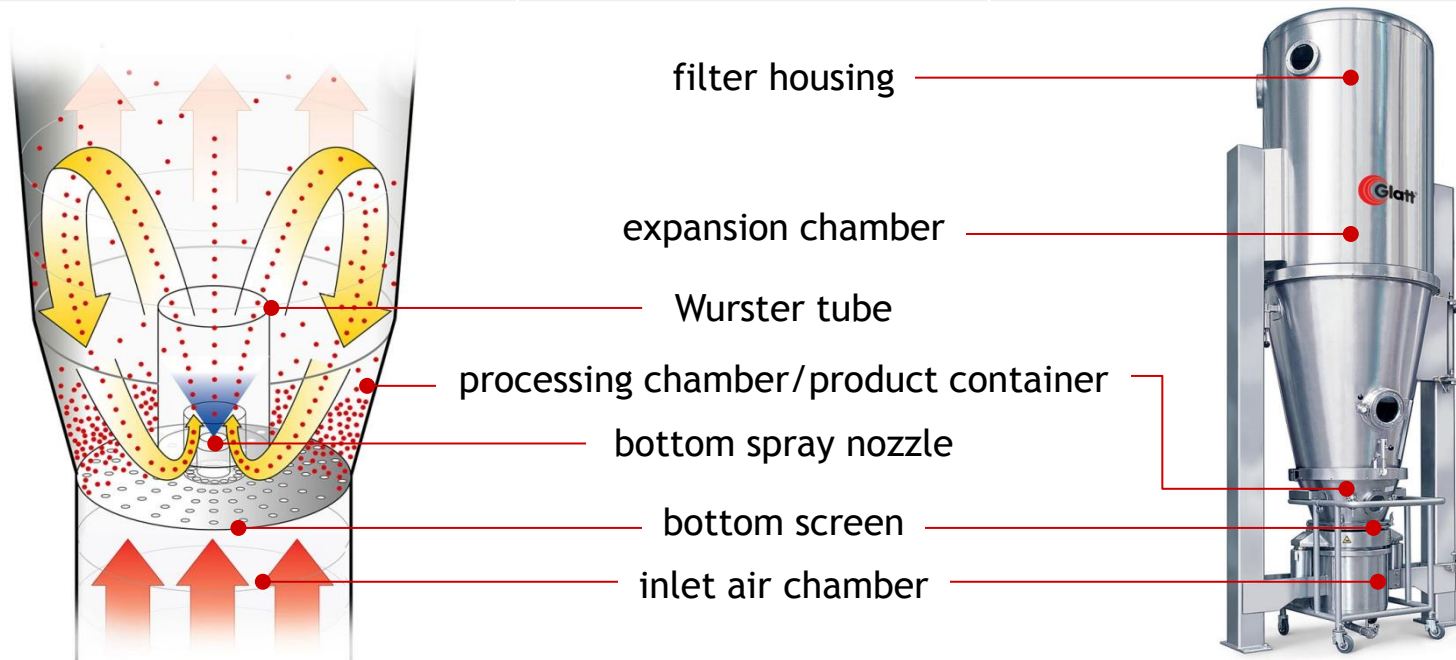
inlet air chamber





# Fluid Bed Technology

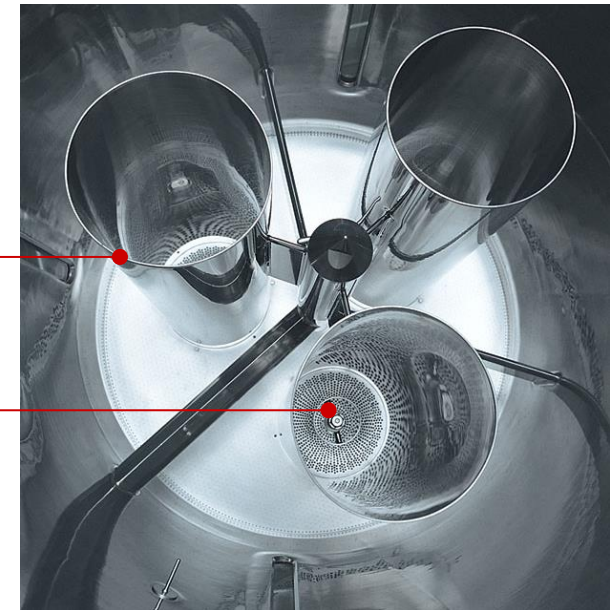
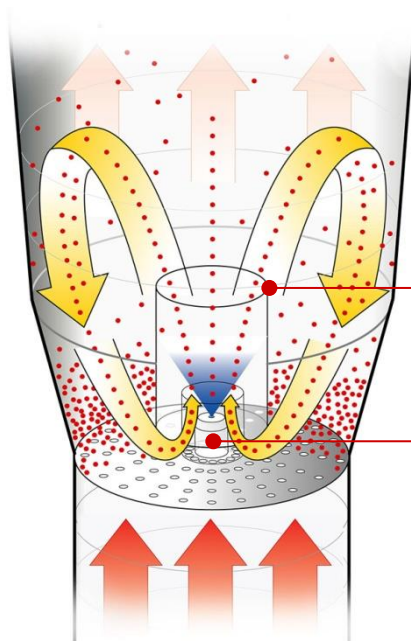
Process Option	Operation Mode	Fluid Bed Equipment
particle coating, powder coating, agglomeration, drying	batch	WS Combo, GPCG with Wurster-bottom spray insert





# Fluid Bed Granulation

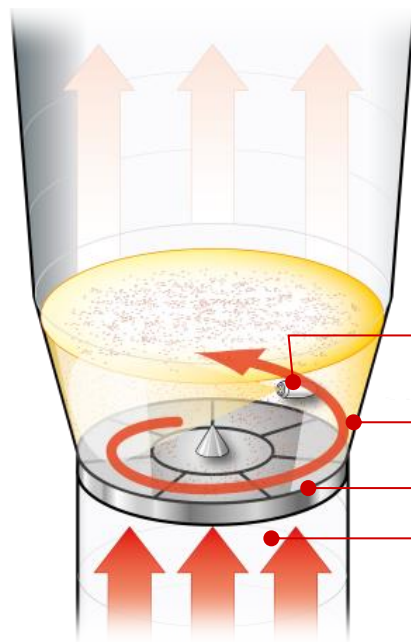
Process Option	Operation Mode	Fluid Bed Equipment
particle coating, powder coating, agglomeration, drying	batch	WS Combo, GPCG with Wurster-bottom spray insert





# Fluid Bed Technology

Process Option	Operation Mode	Fluid Bed Equipment
agglomeration, particle coating	batch	WSG, WS Combo, GPCG with HP spray insert



filter housing

HP tangential spray system

processing chamber/product vessel

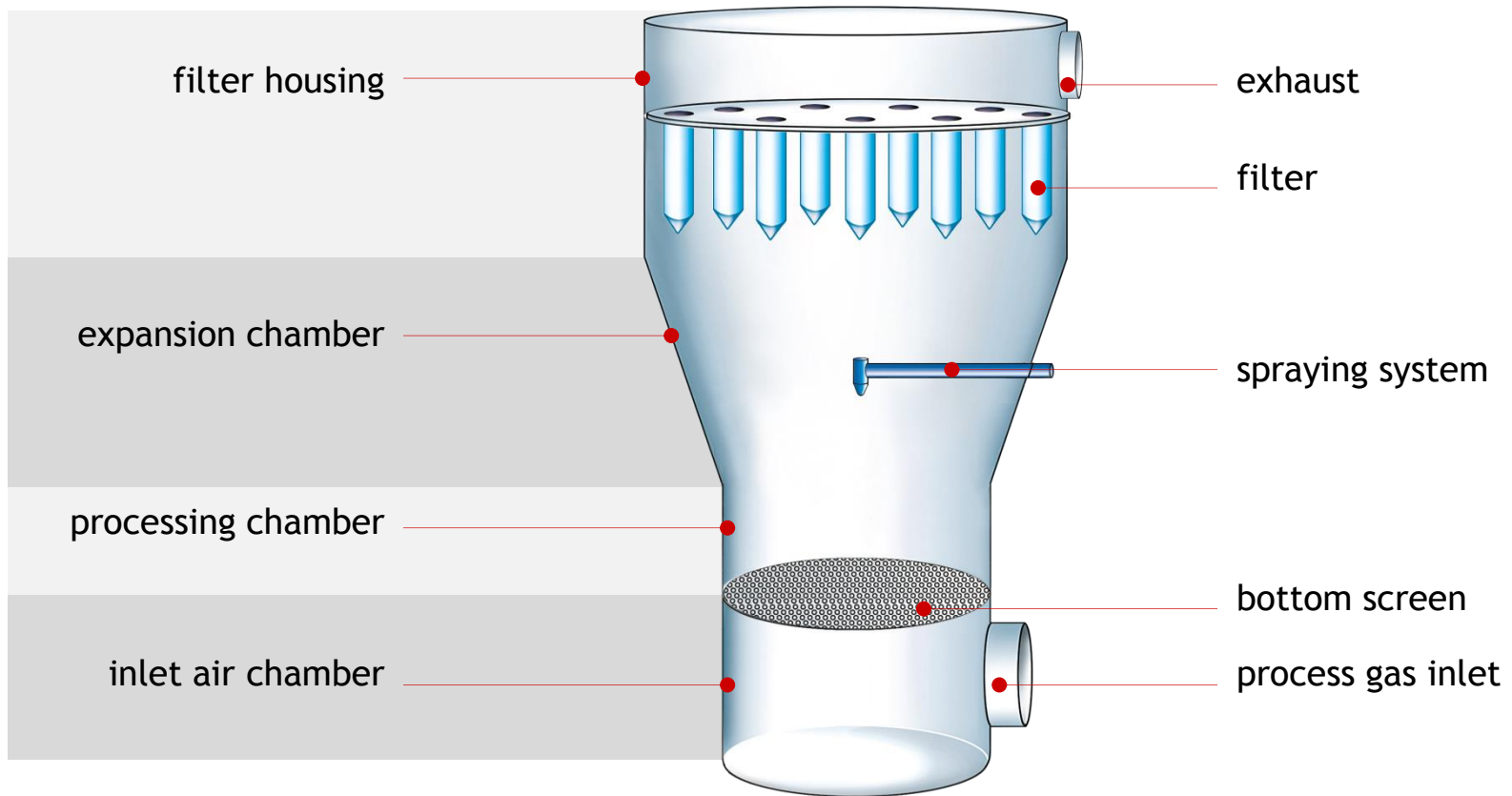
SpinFlow® bottom screen

inlet air chamber



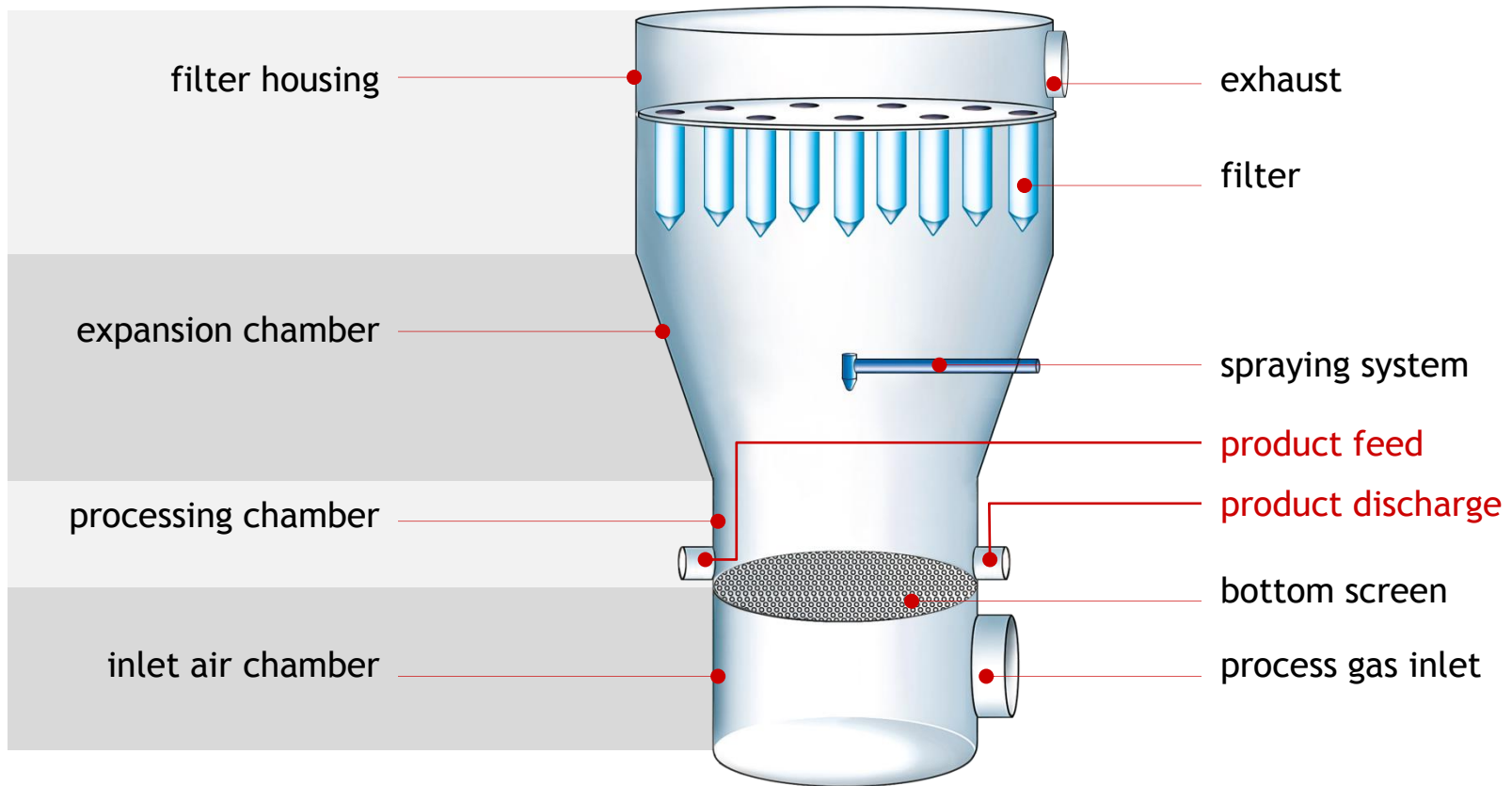


# Fluid Bed Technology - Main Parts of **Batch** Units



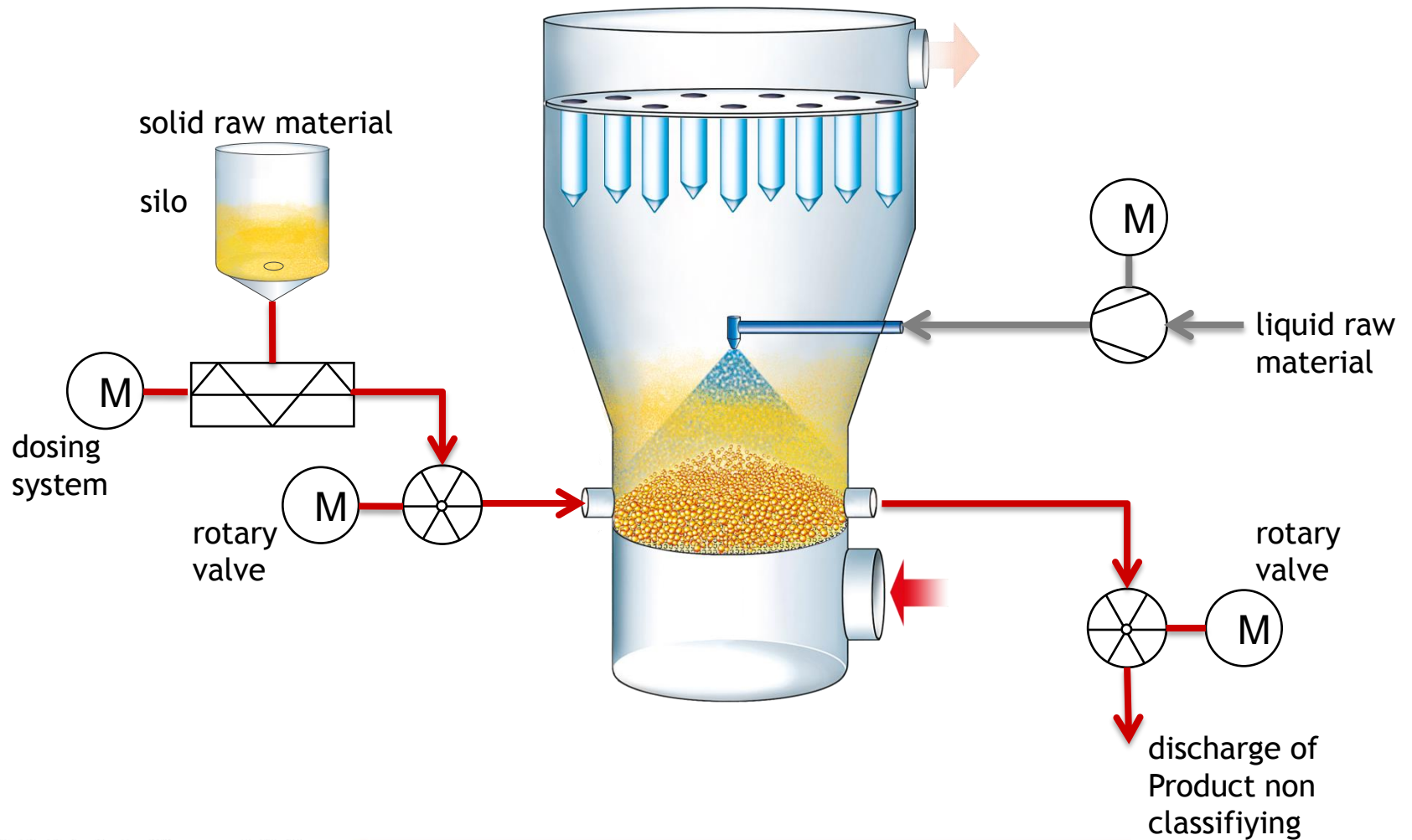


# Fluid Bed Technology - Main Parts of **Continuous** Units





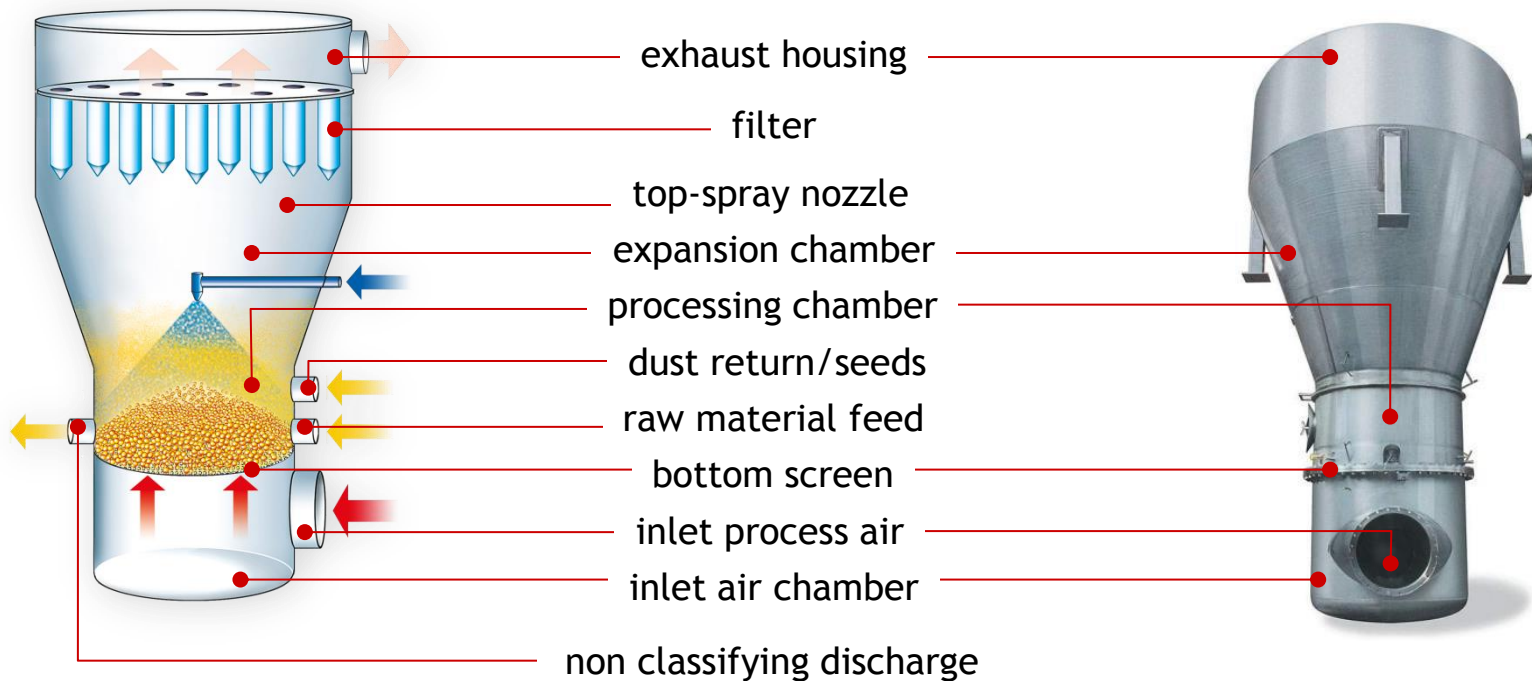
# Fluid Bed Technology - Main Parts of **Continuous** Units





# Fluid Bed Technology

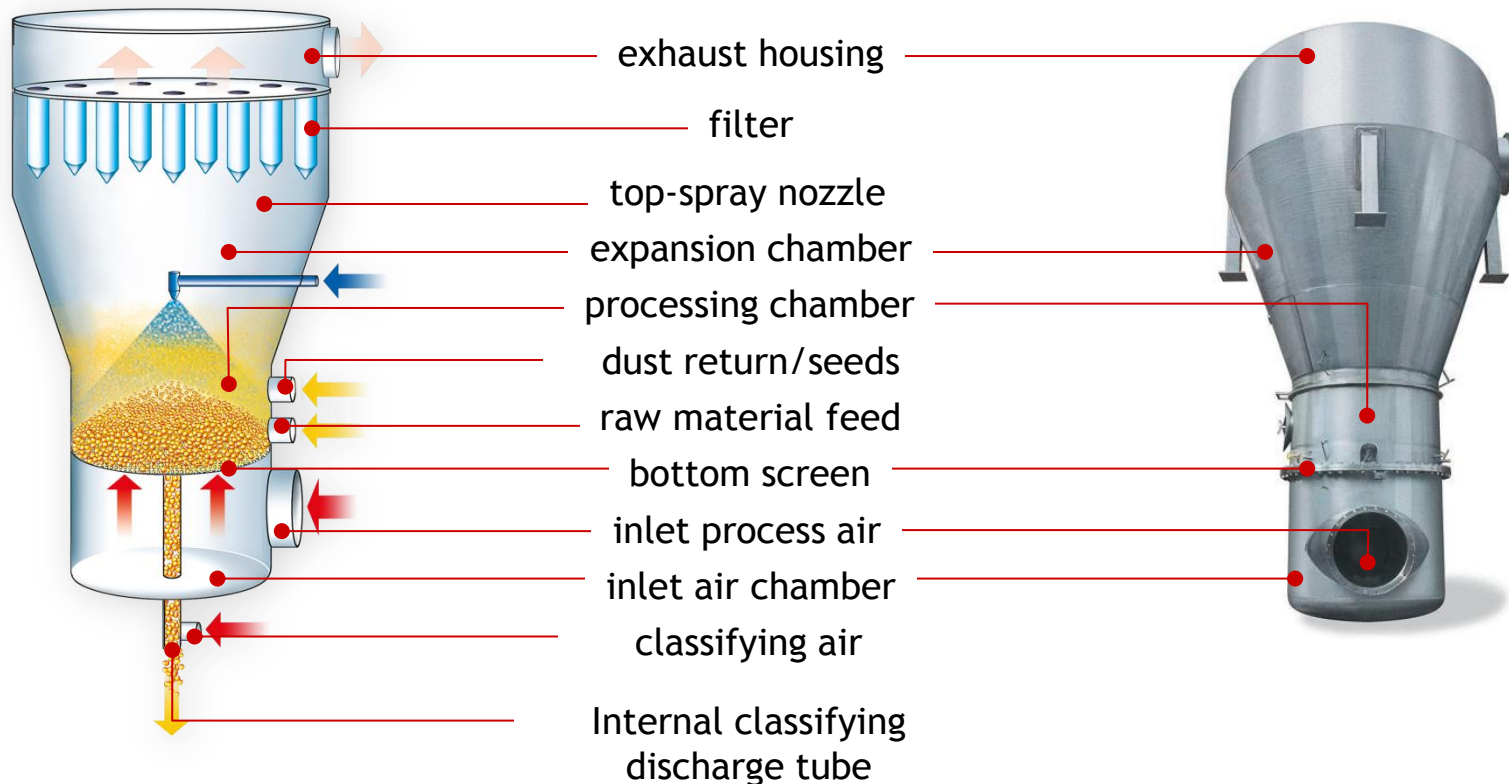
Process Option	Operation Mode	Fluid Bed Equipment
spray granulation	continuous	Glatt Spray Granulator AGT





# Fluid Bed Technology

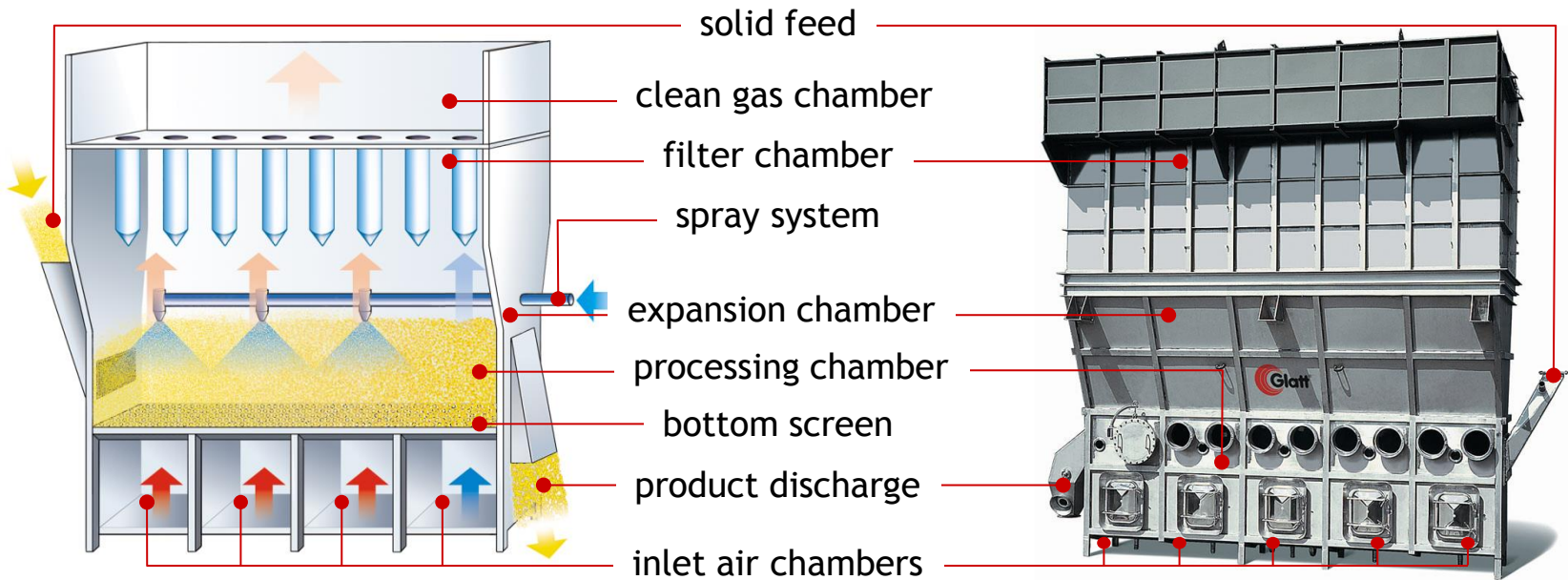
Process Option	Operation Mode	Fluid Bed Equipment
spray granulation	continuous	Glatt Spray Granulator AGT





# Fluid Bed Technology

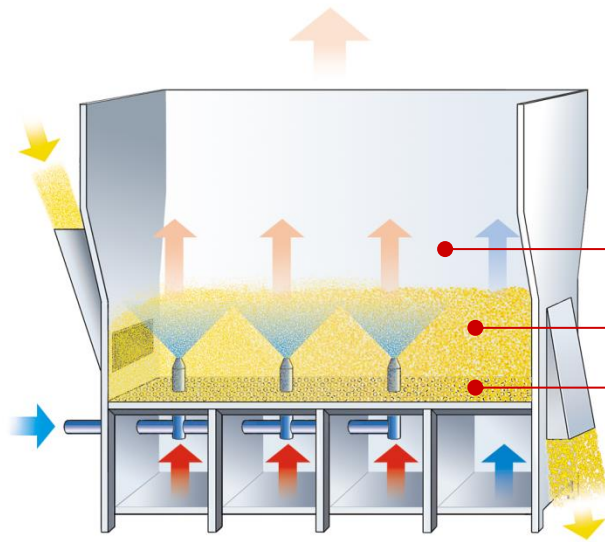
Process Option	Operation Mode	Fluid Bed Equipment
spray granulation, agglomeration, coating, micro encapsulation, drying	continuous	Glatt Fluid Bed Granulator GFG





# Fluid Bed Technology

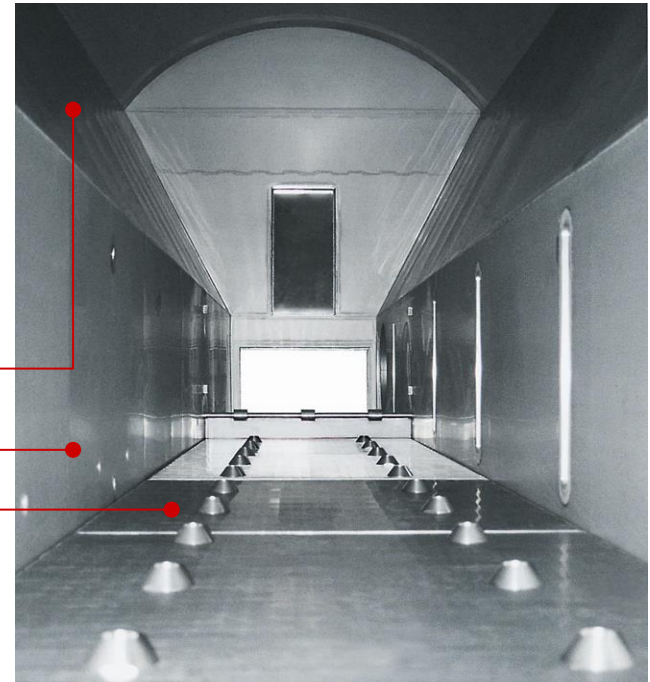
Process Option	Operation Mode	Fluid Bed Equipment
coating	continuous	Glatt Fluid Bed Coater GFC



expansion chamber

processing chamber

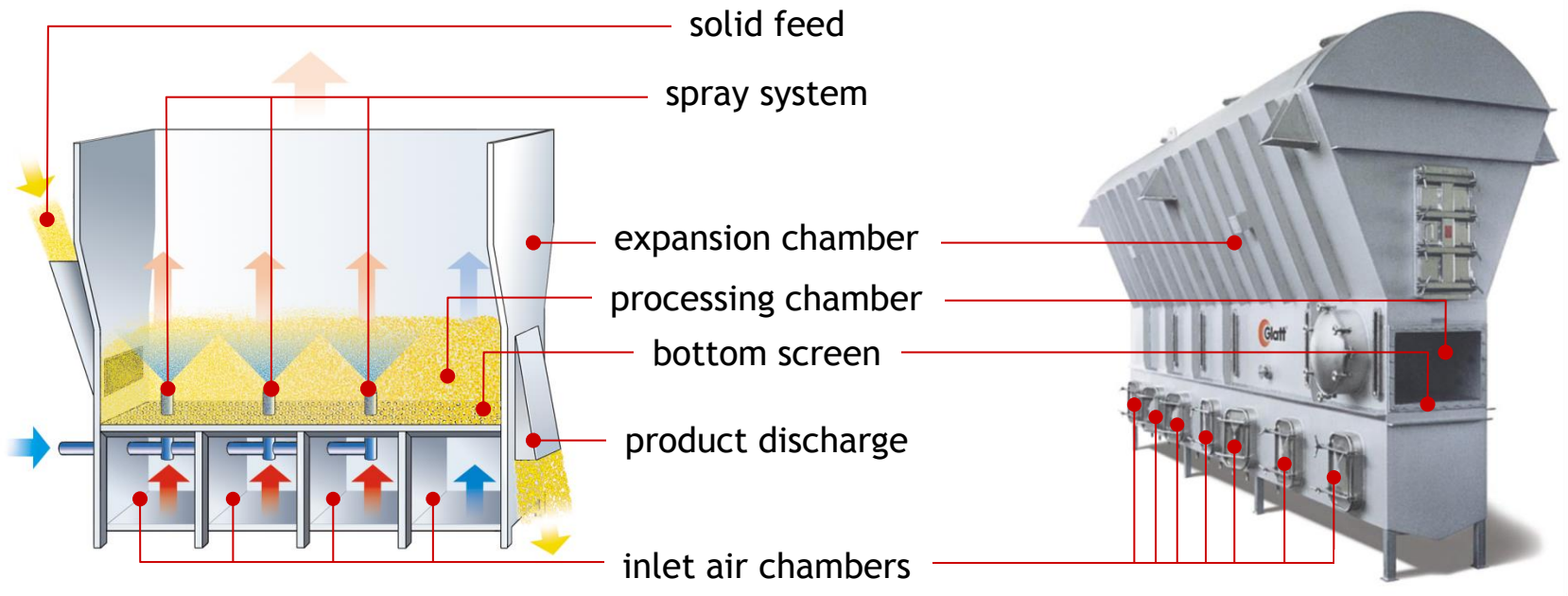
bottom screen





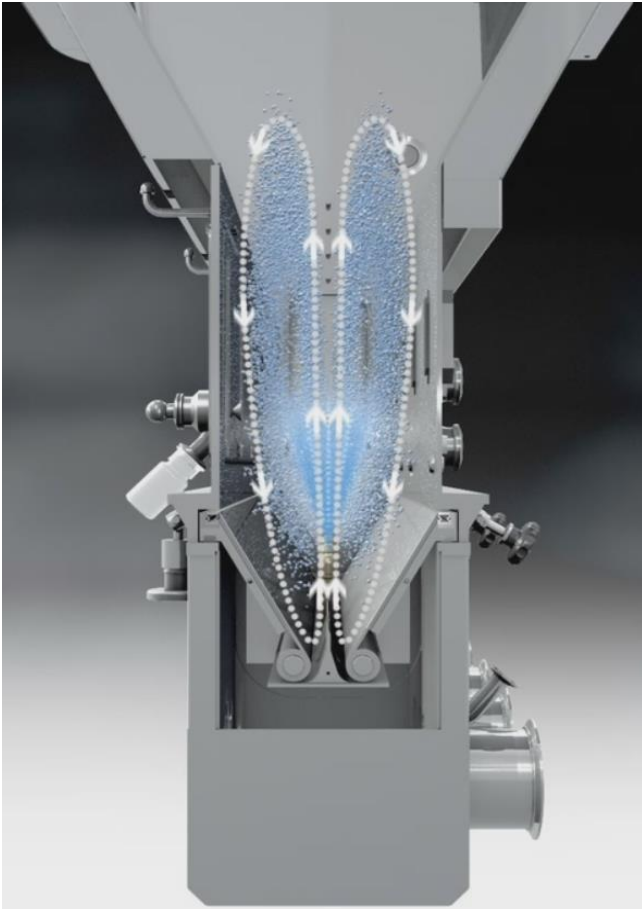
# Fluid Bed Technology

Process Option	Operation Mode	Fluid Bed Equipment
coating	continuous	Glatt Fluid Bed Coater GFC





## Special execution of fluid bed- Spouted Bed Technology - Application Advantages

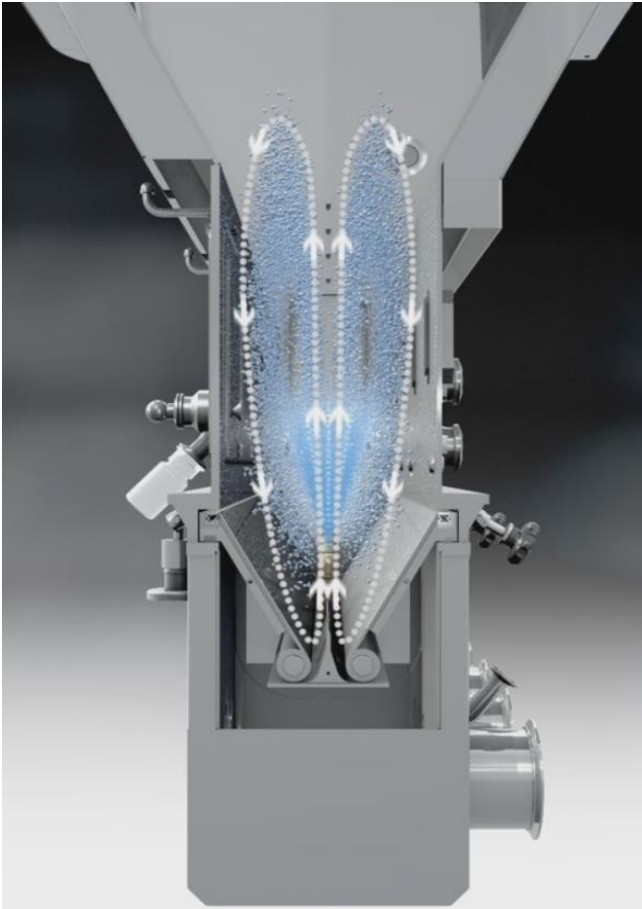


Handling of particles there are difficult to fluidize concerning:






- » very wide grain size distribution or
- » irregular surface structure (tend to aggregate)
- » very fine powder
- » Particle with length/diameter relation  $> 1$
- » high stickiness
- » heat sensitive products
- » residence time sensible processes



## Special execution of fluid bed- Spouted Bed Technology - Design Advantages



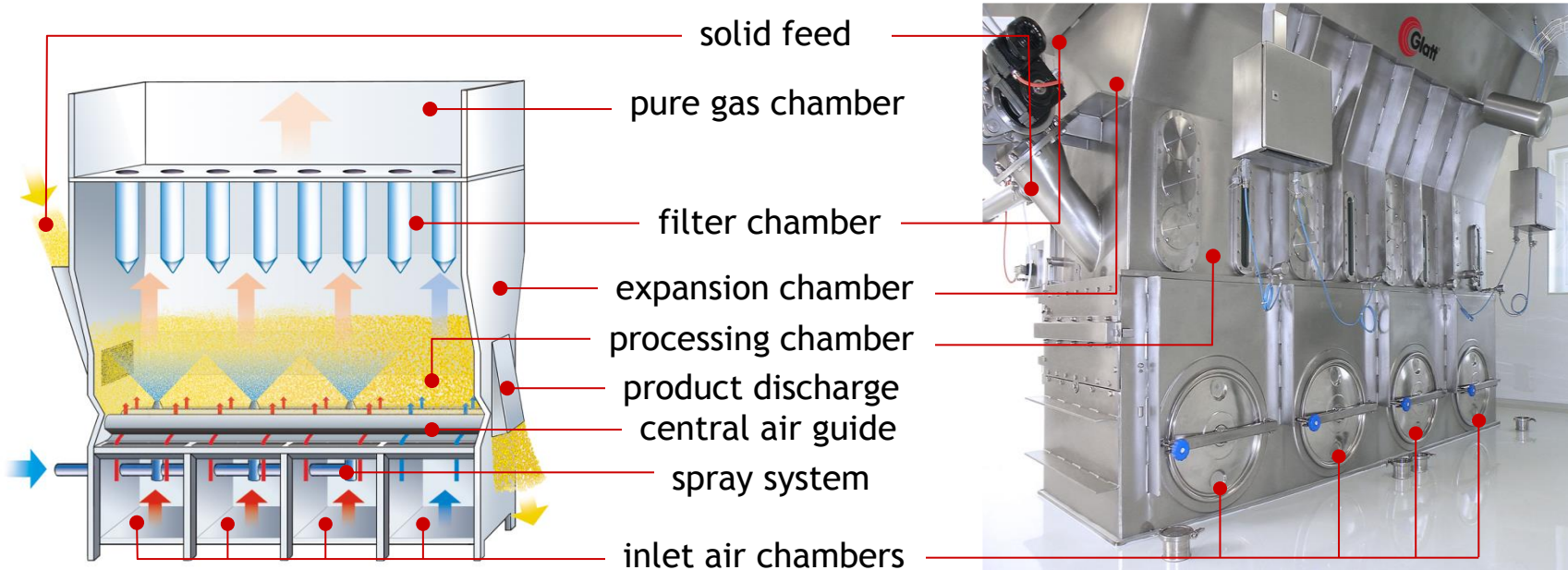
**ALL** fluid bed processes can be realized:

- » no bottom screen  no caking, easy cleaning -
- » “controlled” particle movement   
homogenous wetting
- » hot air enters at point of spraying   
latent heat of evaporation is cooling the product
- » no fluidization outside of spray zone   
particles return to spouting zone without contact the hot air
- » less temperature stress for product   
shorter residence time because design of processing chamber allows less bed material compared to fluid bed
- » granulation of product particle size down to 50  $\mu\text{m}$



# Spouted Bed Granulation-

Process Option	Operation Mode	Fluid Bed Equipment
spray granulation, agglomeration, coating, micro encapsulation, drying	continuous	Glatt Spouted Bed Granulator ProCell





# ProCell LabSystem - Processing Options



- » ProCell system with ProCell 5 and ProCell 10 inserts  
**continuous spouted bed:** spray granulation, encapsulation  
**batch spouted bed:** agglomeration, coating



- » Vario system with Vario 3 and Vario 7 inserts  
**continuous fluid bed:** spray granulation, encapsulation  
**batch fluid bed:** agglomeration, Wurster coating



- » GF system with GF 5 insert  
**continuous fluid bed:**  
spray granulation, encapsulation, agglomeration, coating, drying



- » AGT system with AGT 2 insert  
**continuous fluid bed:**  
spray granulation



- » Rotor system with Rotor 7  
**batch fluid bed:**  
powder layering, spheronizing, direct pelletizing



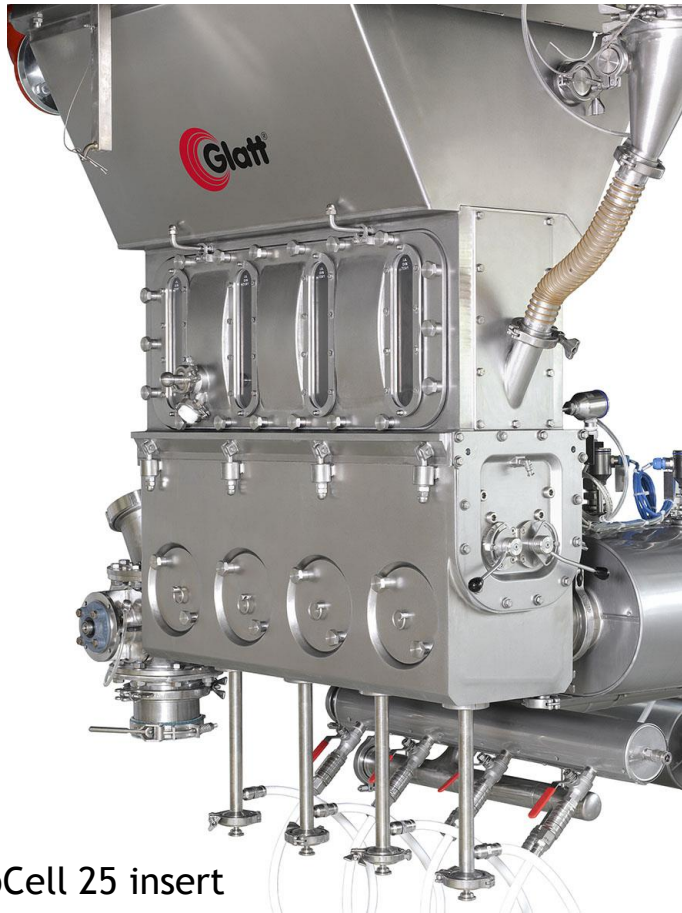
## ProCell LabSystem - Technical Data



process gas volume	40 - 250 m <sup>3</sup> /h <i>500 m<sup>3</sup>/h option</i>
inlet air temperature	200 °C <i>300 °C option</i>
air flow velocity	0.5 - 5 m/s
grain sizes	0.1 - 5 mm
working volume	0.4 - 38 l
spray rate	0.2 - 18 l/h
material flow	200 g/h - 15 kg/h
batch size	500 g/batch - 30 kg/batch



## ProCell PilotSystem - Apparatus Main Parts



ProCell 25 insert



GF 25 insert



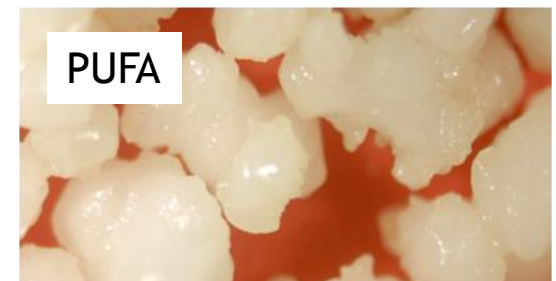
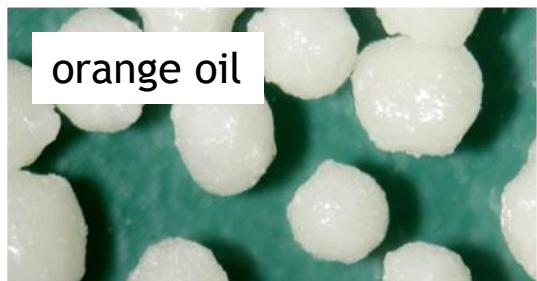
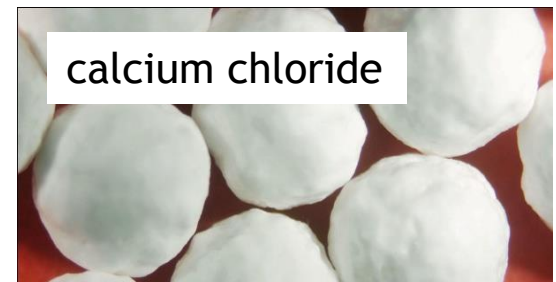
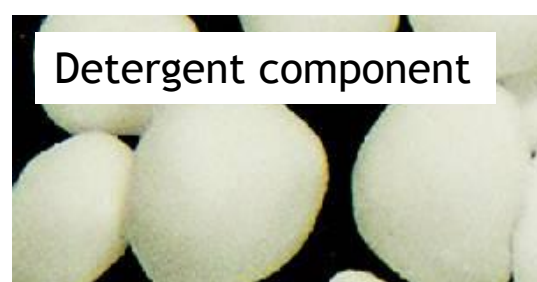
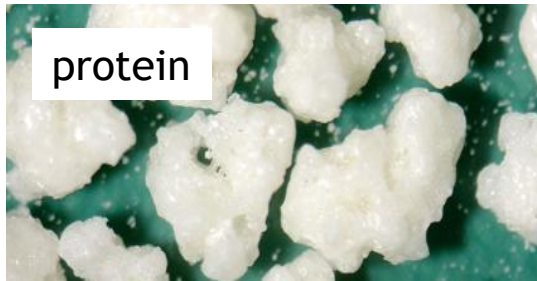
## ProCell PilotSystem - Technical Data



process gas volume	400 - 2,000 m <sup>3</sup> /h
process gas temperature	200 °C
process gas velocity	0.5 - 2 m/s
grain sizes	0.1 - 3 mm
working volume	10 - 40 l
spray rate	5 - 75 l/h
material flow	5 - 30 kg/h
process gas volume	400 - 2,000 m <sup>3</sup> /h

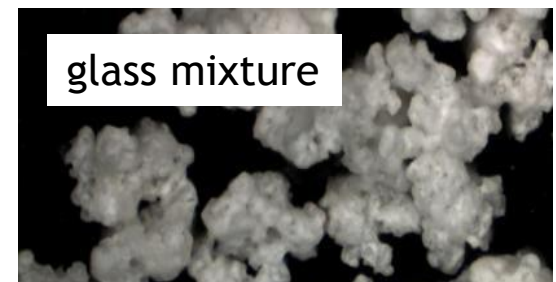
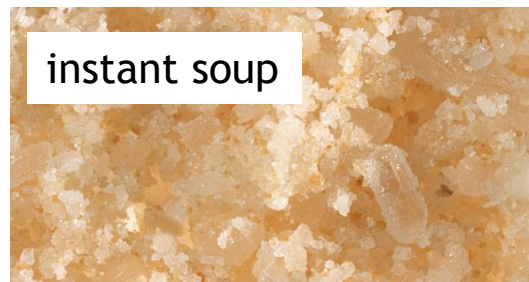
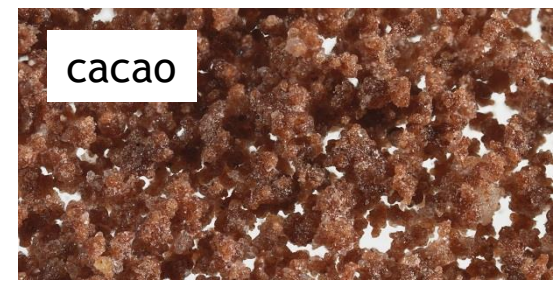


# Application Spray Granulation / + Encapsulation





# Application Agglomeration





# Application Coating / Powder Layering





# Glatt Ingenieurtechnik Weimar Technology Center



HACCP



consulting



lab units



analytics



pilot plants



scale-up



QS / ISO



contract manuf.



powder synthesis



logistics



storage facilities



wet granulation



extrusion



pelletizing



tableting



media



# Process Technology Food, Feed & Fine Chemicals

## Your Contact



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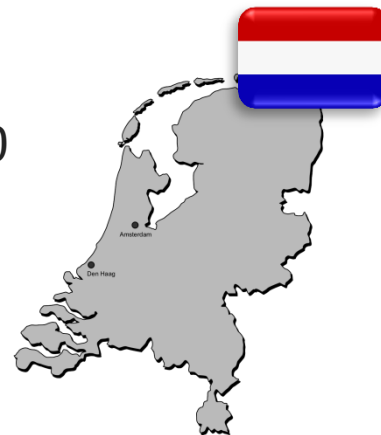
[www.glatt.com](http://www.glatt.com)



# Process Technology Food, Feed & Fine Chemicals Your Local Contact BENELUX

Frits Elferink  
Manager

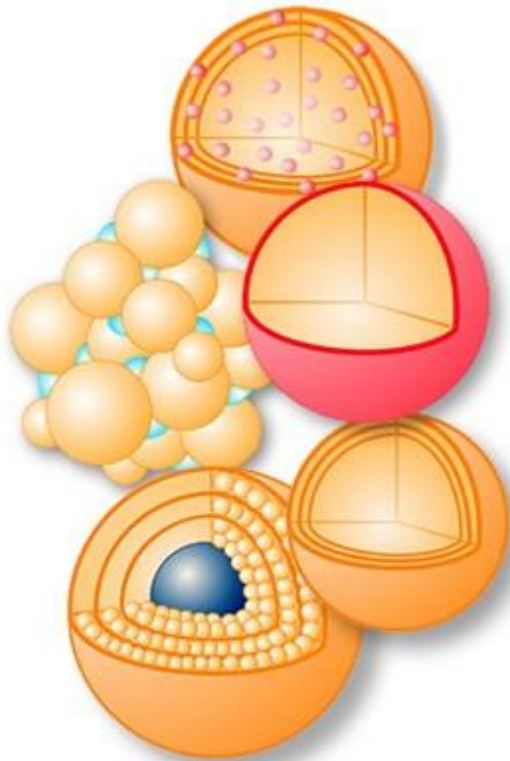
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Thank You for Your Attention



# Questions?

