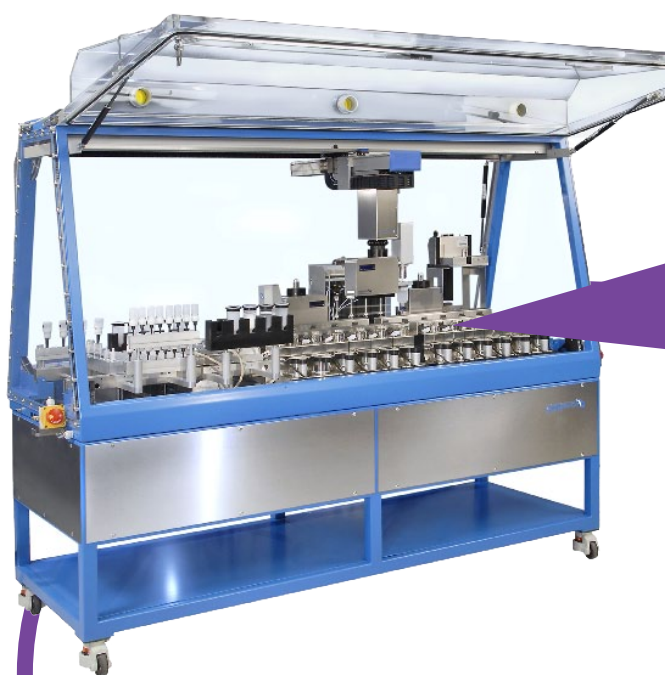


## *MULTIPLANT / AUTOPLANT*

Solutions for Process R&D and Preparative Synthesis



Customer testimonial

"The *AUTOPLANT* paid for itself within less than 12 months"



# Robustness and Ease-of-Use by Design

The leading technology in overhead gravimetric dispensing / dosing (patented) combined with our reactor and process excellence, and our user-friendly software, allow you to standardize and accelerate your process R&D and preparative synthesis workflows.

Precision – Speed – Accuracy  
Performance – Versatility – R&D Cost Savings  
High-Output

## Key Advantages:

- Decrease in cost per experiment up to 90+ %.
- Increase in productivity by a factor of 10+.
- Up to 36 experiments per run on an *AUTOPLANT*, up to 6 experiments per run on a *MULTIPLANT*.
- Independent control of all process parameters in each reactor with PAT like NIR, PSD, calorimetry, pH.
- Independent and precise temperature and stirring control in each reactor.
- Up to 8 independent gas, liquefied gas and liquid feeds per reactor.
- Gravimetric solid and viscous liquid dispensing.
- 4-Needle Head for volumetric liquid handling and sampling.
- Feeding and sampling under reaction conditions.
- Cleaning in place (e.g. automated cleaning, inserts).
- Dispensed amount, stirrer speed, temperature, pressure, time..., and other data are stored in a read only log file.
- Easy access to data with a convenient interface to pull results into Excel or virtually any other software.
- Interface to DOE.



Process research reactor



*AUTOPLANT* workstation

Process development workstation

*MULTIPLANT* workstation

## Enhance your Efficiency and Productivity with our Workflow Solutions!

- Organic synthesis & scale-up.
- Crystallization.
- Ligand synthesis & scale-up.
- Organometallic synthesis & scale-up.
- Ziegler-Natta synthesis.
- Polyolefin prepolymerizations, solution-, slurry-, bulk-, gas-phase, multi-stage syntheses.
- Living / controlled, emulsion, suspension, mass polymerizations.
- Impregnations.
- (Mixed) oxide, zeolite syntheses.
- Catalyst testing in batch, semi-continuous, continuous mode.
- Nanomaterials syntheses.
- Biomass pretreatment and conversion.
- ...

With individual sets of conditions for each reactor!



100 mL, 250 mL, 1'000 mL  
(other volumes upon request)

## Assembly of a process research reactor with our unique screwless and self-sealing design up to 100 bar



1 Choose and insert stirrer



2 Mount cylindric magnetic stirrer drive



3 Plug in reactor



4 Screwless closing and self-sealing of reactor



5 Add safety lock



6 Screwless mounting and self-sealing of multiport drawer valve

No screws  
No gear wheel  
No transmission belt  
Self-sealing



Robustness and Ease-of-Use by Design

## Technical Details

Chemspeed's **MULTIPLANT/AUTOPLANT**'s deck modularity allows the user to execute and perform a variety of workflows in a fully or semi-automated fashion.

The Chemspeed **MULTIPLANT/AUTOPLANT** workstations have been designed for high output experimentation in the development and optimization of pharmaceuticals, agrochemicals, polymers, specialty chemicals, catalysts and many more.

- Process R&D.
- Organic and inorganic synthesis, reactions under pressure (process research, optimization and scale-up).
- Preparative synthesis.
- Validation.
- Polymer synthesis (mass-, solution-, pressure-, emulsion-polymerization).
- Crystallization.

**MULTIPLANT** dimensions:

940 x 600 x 1'920 mm  
(3'1" x 2'0" x 5'4")



**AUTOPLANT** dimensions:

2'350 x 950 x 1'920 mm  
(7'70" x 3'2" x 6'4")



Process development workstation for 6 X 100 mL, 3 X 250 mL, 3 X 1'000 mL

The cutting edge **Process Development Workstation Technology** allows scientists to truly mimic the final industrial production process and provides all the flexibility to optimize integrated reaction sequences, even if a complex configuration of reactors and feed vessels required.

**Process reactor** assembly, individually controlled tank reactors (reactor volumes 100, 250, 1'000 mL) with precise, continuous feeds.

- Flexible and precise continuous feeds, down to 10  $\mu\text{L}$  / min.
- Up to 8 continuous liquid, liquefied gas and / or gas feeds per reactor and additional unlimited overhead access.
- Accurate and reproducible temperature control, 0.1  $^{\circ}\text{C}$ .
- Pressure up to 100 bar over the entire temperature range up to 250  $^{\circ}\text{C}$  with corresponding safety installations.
- Parallel high-performance calorimetry data.
- Viscosity data.
- Dean Stark water trap.
- Distillation bridge between 2 reactors.
- Vacuum for different purposes: inertization, crystallization, ...
- Interface to various in-situ probes, for example: pH, UV-VIS, IR, Raman, PSD.
- pH monitoring and control.
- Measurement of gas consumption.
- Extraction, filtration, evaporation, crystallization, distillation.
- Reflux.



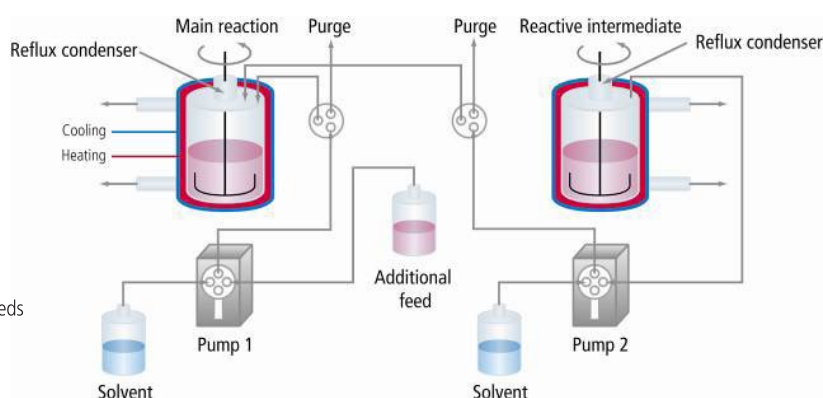
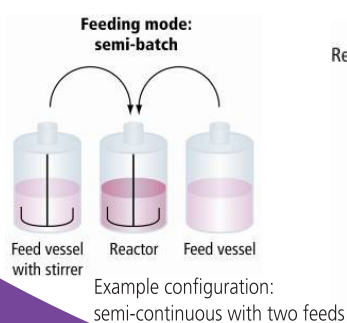
Materials of choice: glass, stainless steel (PEEK, PTFE or glass inserts available), Hastelloy, others on request



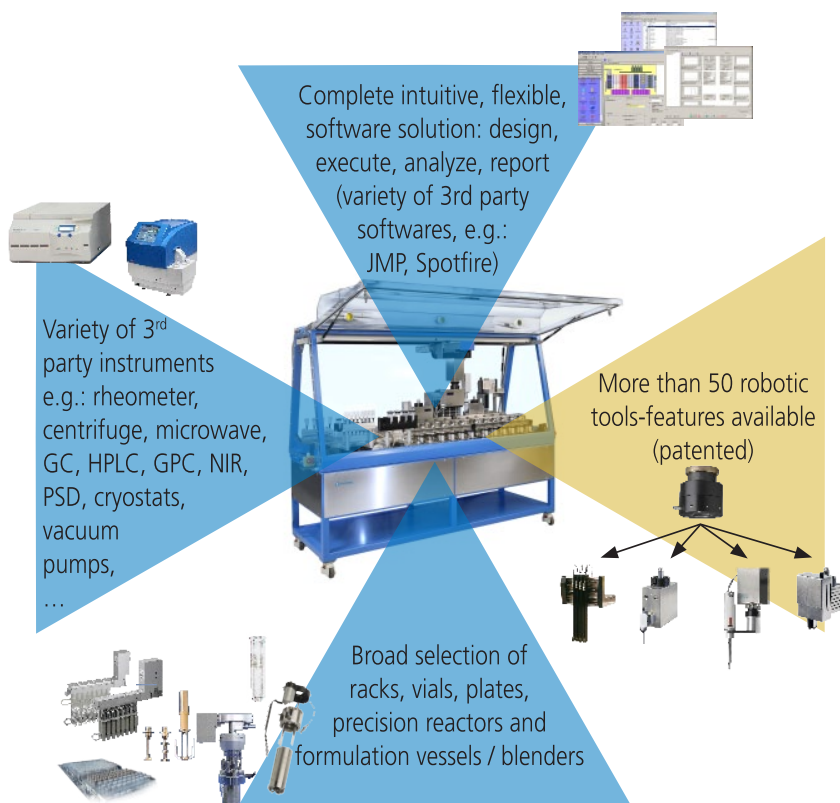
Easily exchangeable stirrer designs (anchor, twisted blade, gas entrainment stirrers...). Powerful mixing for viscosities up to 80 Pa·s at 300 rpm and 30 Pa·s at 900 rpm with an anchor stirrer.

## Flexible Configuration

For one single unit, various feeding modes are available: batch, semi-continuous, continuous, continuous cascade.



# 4 Dimensions of Modularity and Flexibility



## – Off-the-Shelf-Design –

- Individual platform configuration tailored to your workflow with market-proven off-the-shelf components.
- Robotic platforms which can easily be integrated with one another to enable multi-workflow processes (e.g. Formulation, Application and Testing procedures all integrated in a single platform).

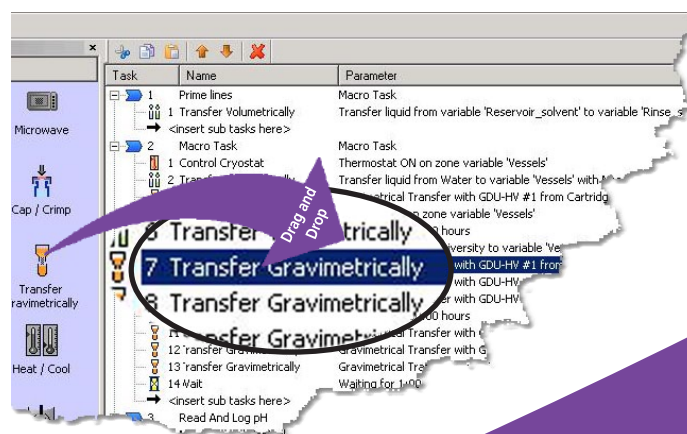


## Complete Software Solution: Design, Execute, Analyze, Report

Chemspeed's AutoSuite User Interface & Executor software packages execute and control all modules of the entire product development cycle. They control all Chemspeed robotic platforms and any other integrated 3rd party software and hardware.

AutoSuite **MULTIPLANT/ AUTOPLANT** is a software with a user friendly interface which allows easy workflow oriented programming. Many features such as gravimetric dispensing are automatically calibrated, eliminating tedious optimization steps.

- The AutoTeaching tool simplifies dispensing applications without manual trials and is applicable to e.g. solids eliminating the need for manual optimization before the dispenses are done.
- **Easy programming: drag-and-drop workflow steps or just execute standard workflow protocols.**
- Barcode tracking.
- Easy integration with virtually any LIMS or ELN software.
- AutoSuite Application Programming Interface (API) for 3rd party software and hardware integration.
- Optional, Chemspeed VLab for DoE and Data Analysis / Reporting. It includes a full document management system (electronic lab-journal) and is 21 CFR Part 11 compliant. The software scales from a single PC to large network installations with multiple hardware and clients.

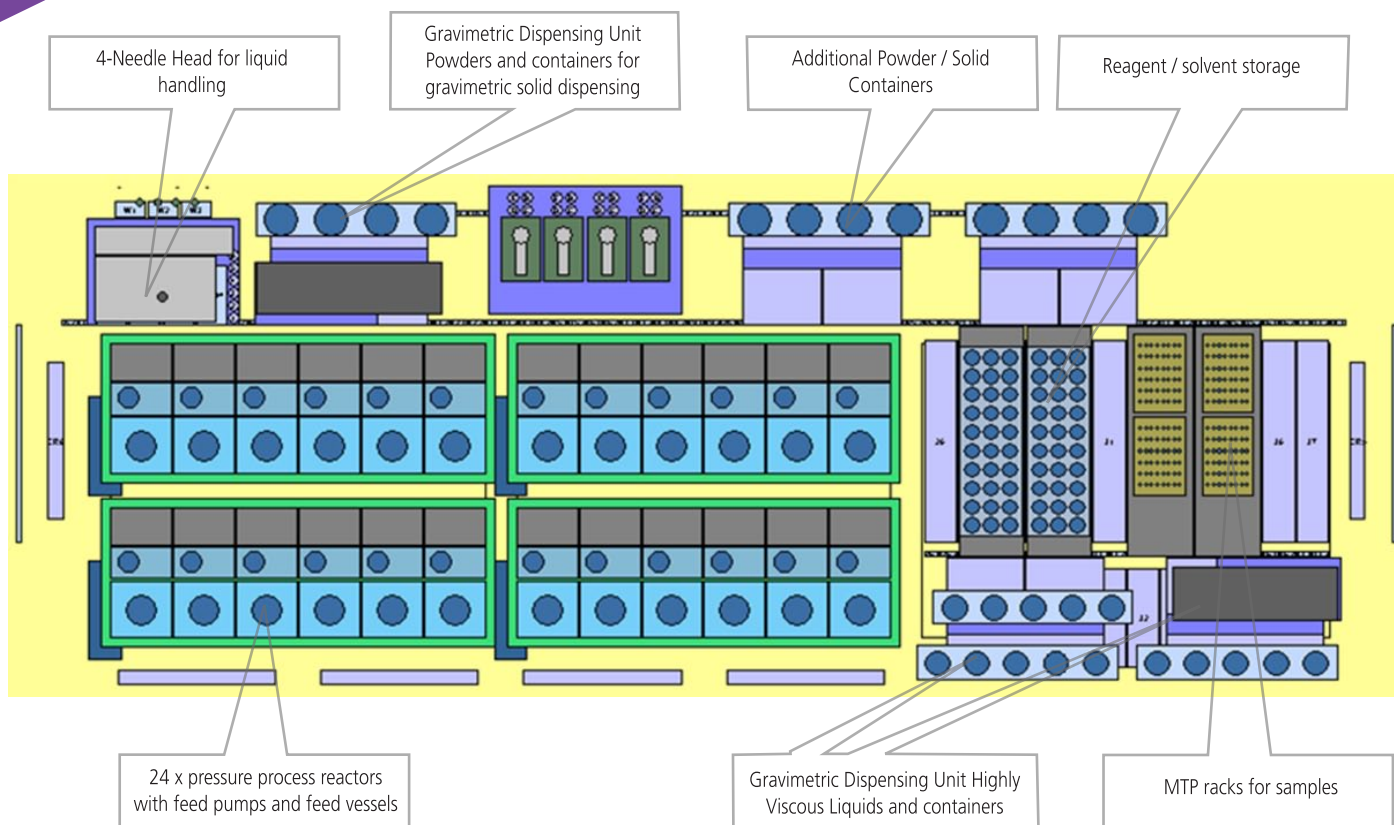


Easy Programming – Intuitive interface



## Platform Configuration Example

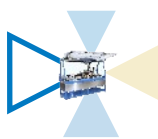
A typical **AUTOPLANT** deck consists of up to 36 independently controlled tank reactors, along with reagent / sample and solid dispensing container racks. Tools include a 4-Needle Head for liquid additions, Solid Dispensing Unit for liquid additions, Solid Dispensing Unit for the addition of solid reagents.



All tools and accessories from Chemspeed's **SWING, ISYNTH, FORMAX, APPLICATOR** and **INVESTIGATOR** platforms are fully compatible with the **MULTIPLANT / AUTOPLANT** platforms and vice versa.

Example upgrade options:

- Various reactor materials and coatings are available (glass, hastelloy, Teflon, PEEK,...).
- Multiple stirrer designs and materials.
- Large choice of sample, reagent, and customized racks.
- Integrated NIR, particle size distribution (PSD), and viscosity measurement.
- (Heated) sampling for online or offline analytics (GC, HPLC, GPC,...).
- (Heated) sampling for offline analytics (NMR, MALDI-TOF, AFM,...).
- (Heated) sampling for online and particle size distribution analysis.

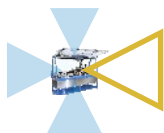


## Variety of Plug-in (3rd Party) Solutions

Chemspeed integrates a large number of 3rd party components either on and / or off the deck.

Available upgrade options:

- Analysis module (GC, HPLC, GPC,...).
- Cleaning module.





# Robotic Tool-Features


More than 50 robotic tool-features can be integrated with Chemspeed's unique robotic tool exchange technology, including unrivalled overhead gravimetric dispensing, which can operate while mixing, heating, refluxing and cooling. Virtually any combination of these robotic tools is possible.

Highlighted are the most common and recommended robotic tool-features for the **AUTOPLANT** robotic platform.

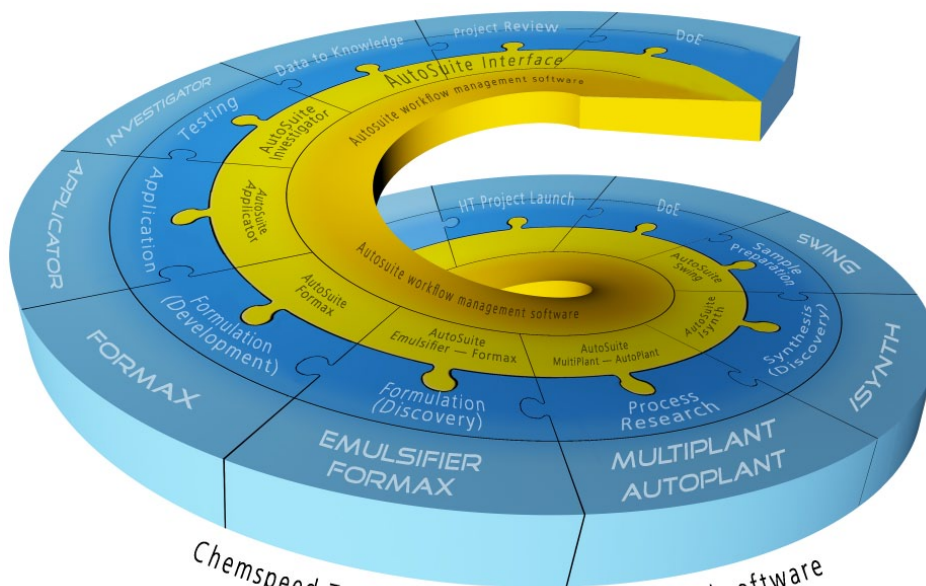


Robotic tool exchange interface (proprietary)

Precision balance Overhead gravimetric dispensing robotic tools (proprietary)	Volumetric dispensing robotic tools	Action robotic tools	Analytic robotic tools
<ul style="list-style-type: none"> <li>Overhead gravimetric dispensing of solids &amp; powders (0.1 mg to 20 g) Dispensing container volume: 15 mL or 30 mL resolution: 0.1 mg (or 0.01 mg with a second balance)</li> </ul> 	<ul style="list-style-type: none"> <li>Liquid handling powered by 4 syringe pumps (syringe volumes: 1, 10, or 25 mL) for viscosities from 1 mPa·s to 100 mPa·s</li> </ul> <p>Special options:</p> <ul style="list-style-type: none"> <li>Disposable tips (1'200 µL)</li> <li>Disposable syringes</li> <li>Heated needles (up to 100°C)</li> <li>Spray needles</li> <li>pH and temperature measurement and control</li> <li>Coated needles, PEEK needles...</li> </ul> 	<ul style="list-style-type: none"> <li>Multigrripper for vial and MTP transport and much more</li> <li>Automated barcode scanner</li> </ul> 	<ul style="list-style-type: none"> <li>Online density measurement (aspiration technology), on the fly resolution: 1 mg (or 0.01 mg with second balance)</li> </ul> 
<ul style="list-style-type: none"> <li>Overhead gravimetric dispensing of solids &amp; powders (1 mg to 100 g, larger volumes are available) Dispensing container volume: 100 mL resolution: 1 mg (or 0.01 mg with a second balance)</li> </ul> 	<ul style="list-style-type: none"> <li>Liquid gas dispensing with gravimetric control resolution: down to 0.1 mg</li> </ul>	<ul style="list-style-type: none"> <li>Screw capper Vial diameter range: from 10 mm to 50 mm Larger ranges available Torque range: from 0.1 Nm to 1 Nm</li> </ul> 	<ul style="list-style-type: none"> <li>Brookfield Viscosimeter (RVDV-II+ Pro BK)</li> </ul> 
<ul style="list-style-type: none"> <li>Overhead gravimetric dispensing of highly viscous liquids, pastes and creams (1 mg to 100 g) with viscosities from 1 mPa·s to 500'000 mPa·s (based on Newtonian substances) resolution 1 mg (or 0.01 mg with a second balance)</li> <li>Optional aspiration feature</li> <li>Optional transfer of hot (up to 90 °C) substrates via heatable cartridges (e.g. for waxes)</li> </ul> 	<ul style="list-style-type: none"> <li>Overhead gravimetric / volumetric aspiration and dispensing of viscous liquids (0.1 µL to 12.5 mL) with viscosities from 1 mPa·s to 15'000 mPa·s via disposable positive displacement syringes, resolution: down to 1 µL</li> </ul> 	<ul style="list-style-type: none"> <li>Capping, crimping (N8 / N11 / N13 / N20)</li> <li>Decapping (N8 / N11 / N13 / N20)</li> </ul> 	<ul style="list-style-type: none"> <li>Tri gloss measurement</li> <li>Thickness measurement</li> <li>Color measurement</li> <li>Precision tack-cure</li> </ul> 
<ul style="list-style-type: none"> <li>Overhead gravimetric aspiration and dispensing of viscous liquids (1 mg to 100 g) with viscosities from 1 mPa·s to 15'000 mPa·s via disposable positive displacement syringes, resolution: 1 mg (or 0.01 mg with a second balance)</li> </ul> 		<ul style="list-style-type: none"> <li>High shear homogenization (11'000 to 30'000 rpm)</li> </ul> 	<ul style="list-style-type: none"> <li>Camera</li> <li>Observation of dissolution</li> <li>Particle size distribution and dynamic light scattering</li> </ul>
		<ul style="list-style-type: none"> <li>Overhead stirrer (20 to 200 rpm) Different stirrer types available</li> </ul>	
		<ul style="list-style-type: none"> <li>Ultrasonic dispersion (100 W)</li> </ul> 	
		<ul style="list-style-type: none"> <li>Vacuum / Degassing</li> <li>Reflux condenser</li> <li>Evaporation</li> <li>Filtration</li> </ul>	
		<ul style="list-style-type: none"> <li>High speed injection molding</li> <li>Foam formation</li> </ul>	
		<ul style="list-style-type: none"> <li>Draw-down with disposable or reusable precision spiral and / or gap bars</li> <li>Free film generation</li> <li>Dip coating</li> <li>Spray coating</li> <li>Wet-on-wet coating</li> </ul> 	
		<ul style="list-style-type: none"> <li>Robotic transfer arm to serve 3rd party instruments e.g. centrifuge</li> </ul> 	

15+ Years of Experience in Automated Chemistry.  
 Customized Workflow Solutions.  
 Swiss Quality Products.  
 An International Team of Highly Experienced Chemists.

Chemspeed Technologies AG is the leading provider of high-throughput and high-output research & development workflow-solutions from single bench-top / standalone automated workstations (powder dispensing - sample preparation- synthesis - process development - formulation - application - testing) up to complete and integrated product development workflows for the entire product development processes in the chemical, material science, renewables & energy, pharmaceutical, agro-chemical, specialty chemical, home care, cosmetics and nutrition industries, as well as academia.



*Chemspeed Technologies offers hardware and software for every step in the product development cycle*

Discover our enabling portfolio for the entire product development cycle!

