

## SPR100/4 SLURRY PHASE REACTOR



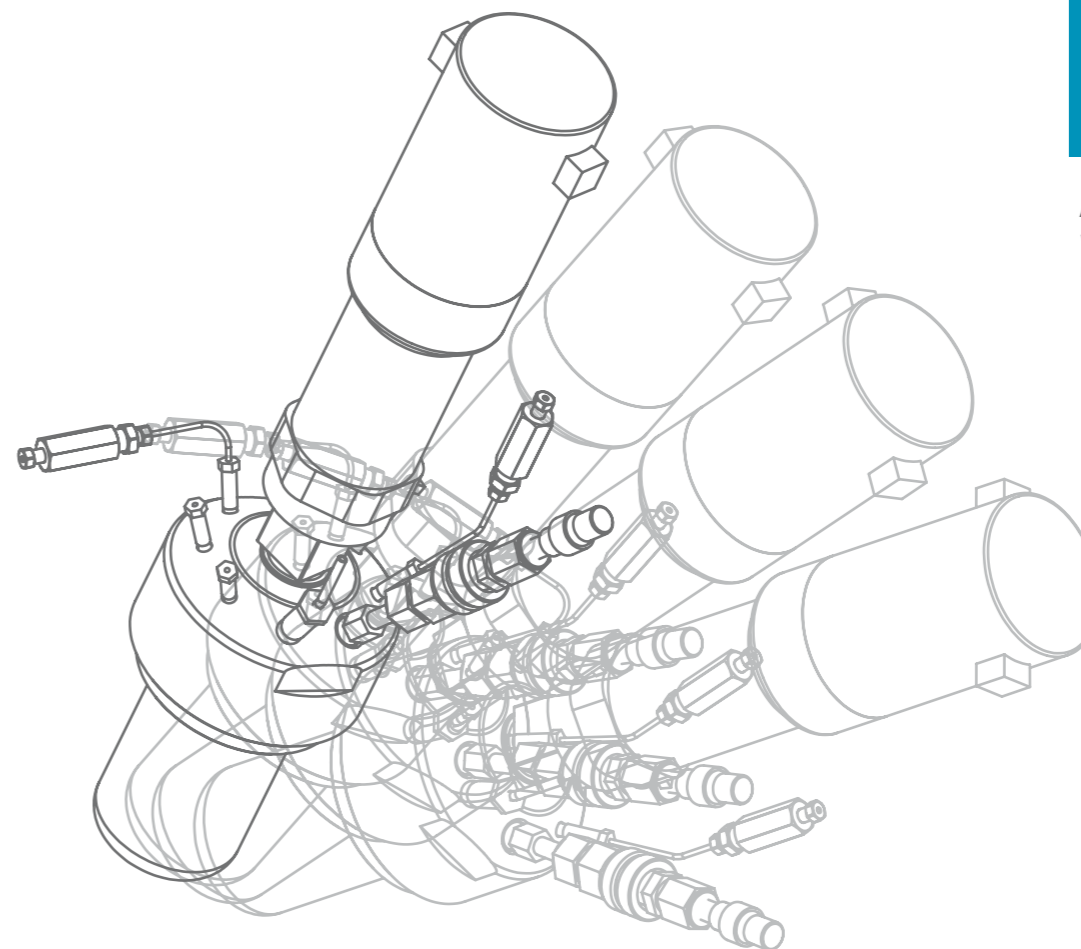
SPR100/X/Y

X: Number of reactors, modular in multiples of 2  
 Y: Special options, including; C: CSTR mode;  
 P: Polyolefin version; HT: High temperature version

Product Information

## SPR100/4 SLURRY PHASE REACTOR

A parallel reactor system  
 with automated sampling  
 under reaction conditions.


**amtech**  
 high throughput technology

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All specifications are subject to change without notice.

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### Designed for

- Catalyst and Material Screening (primary and secondary)
- Kinetic Studies
- Polyolefin Chemistry
- Process and Engineering Research

... Highest Level of Automation

Advanced Machinery and  
 Technology Chemnitz GmbH



## Introduction

Using parallel reactor systems to investigate multiphase heterogeneous or homogeneous catalytic reactions can improve lab productivity, accelerating catalyst development and enabling rigorous kinetic studies to be carried out.

After the success of the SPR16 we introduced the SPR100/4 in 2007 as a further development. The SPR100/4 features larger reactors with internal cooling, flexible dosing and stirring options. The system is fully modular, based on an individual unit containing two reactors. In addition, the reactors can be modified to operate as individual or cascaded continuous stirred tank reactors (CSTR). Further modified versions are available, which have been designed for investigation of polyolefin chemistry and high temperature applications.

## Specifications

### System

- > 4 independent batch reactors, fully modular based on basic unit with 2 reactors
- > Individual temperature, individual pressure control and individual stirring speed in each reactor
- > Automated feeding of gas and liquids
- > Liquid sampling under process conditions
- > O-ring reactor sealing mechanism
- > Graphical user interface, different operator levels
- > Historical trending of all process parameters

### Standard Operating Limits

- > Reactor volume 100 ml
- > Operating pressure up to 150 bar
- > Stirring 0 - 800 rpm

### The SPR100/4 is available in modified versions, including:

- > CSTR option, where the reactors can be operated as a continuous stirred tank reactor or a series of continuous stirred tank reactors
- > Polyolefin option, which includes ethylene and propylene dosing, individual automated catalyst feed pumps per reactor, the liquid sampling system is omitted
- > High temperature version, with reactor maximum operating temperature of 450°C



## Applications

The system design covers a wide range of applications and reaction conditions, and has been validated for a wide range of heterogeneous and homogeneous multiphase batch catalytic processes e.g. hydrogenations, polymerisations, carbonylations or hydroformylations, oxidations or hydrogenolysis.

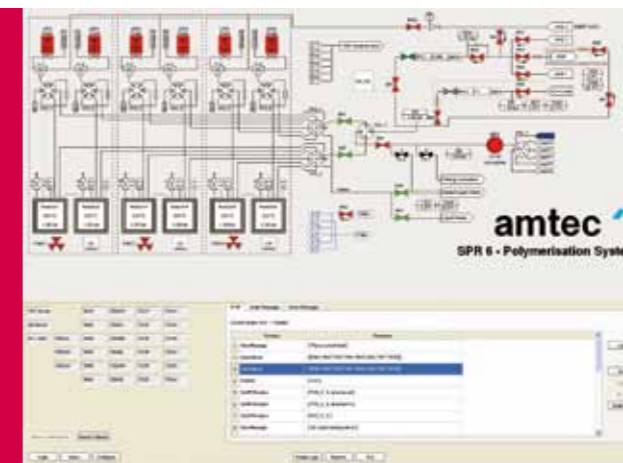
It is therefore an attractive tool for carrying out catalytic studies in the fine chemical, life science, polymer and bulk chemical industries.

The system can optionally be tailored for use in polyolefin chemistry, with ethylene & propylene dosing and individual pumps for dosing of air sensitive catalysts and co-catalysts. In addition to feeding liquids using the HPLC pump, air sensitive liquids and homogeneous catalysts can be fed into the reactors either directly under inert gas flow or using the integrated injection valve.

In a modified version each reactor can be run as a CSTR or series of CSTRs, enabling research in GTL, process development and chemical engineering to be carried out.

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## System

### Reactor Array

Each autoclave reactor is designed for an optimum heat and mass transfer, with an internal cooling coil for isothermal operation. The small internal volume of 100ml saves expensive catalyst and feedstock resources. Standard material of construction is stainless steel 316L, other materials like Hastelloy® C276 are available on request. Each reactor is equipped with individually adjustable heating, stirring, and a certified rupture disc in the reactor lid.

### Heating & Stirring

The reactors are stirred using top stirrers with a maximum power of 60Ncm, and the stirrer blades used can be changed by the user to fit the application. Each reactor is heated by an individual electrical heating jacket, and the reactors can be heated up to 250°C during pre-treatment and 220°C during reactions.

### Automated Gas & Liquid Feeding

All 4 reactors are connected to gas and liquid supplies via a selection valve system. A pressure sensor is used in combination with a Mass Flow Controller for gas supply in order to control the pressure in the reactors. The number of feed gases is customer specific (two reactant gases and one inert gas as standard). An integrated HPLC pump is used to fill the reactors with liquid solvents and reactants under pressure. Each reactor can be fed with different amounts and types of liquids and gases, and can be operated at an individual pressure.

### Sampling

A novel technique enables automated and reproducible liquid sampling under process conditions without disturbing the reaction. Multiple samples can be obtained from each reactor because of the small sample volume (standard 100µl, a range of sizes is possible). The samples are injected into sample vials via an integrated robotic system for subsequent analysis using chromatographic or spectroscopic methods. Samples can be automatically diluted. Customisation of the sampling process for online analysis is also available. In this way liquid composition can be monitored as a function of time.

### Automation & Data Management

The entire system is controlled via an integrated PLC in combination with a control PC for visualisation. The graphical user interface allows manual operation of the system as well as visual depiction of the system status. The system is provided with a scheduling tool for experimental planning, the specific experimental subroutines can be adapted to meet the specific requirements of the application and other customer demands. An easy to use experiment scheduling software is provided. System status can be monitored via a LAN connection using a standard web browser. Process and sample data is stored in a MySQL database, and results from most analysis devices can be integrated into the database. All process parameters can be viewed in tabular and graphical form during experiments.

### Safety

A programmable safety PLC is integrated within the system to manage alarms. Multiple alarm classes are featured, and the alarm settings and responses can be adapted to meet on-site safety regulations.