FLUIDIZED BED
PROCESS TECHNIQUE

High temperature reactors for gas / solid reactions up to 1100 °C

SCHWING
TECHNOLOGIES

FLUIDIZED BED REACTORS

SCHWING supplies fluidized bed reactors as stand-alone components or within a complete system. The customer requirements and/or the application thereby determine the reactor type and the scope of the system.

The systems from SCHWING can be designed as individual components or complete systems, including control, gas preparation, energy recovery, product cooling. Planning, engineering and manufacturing of all systems thereby always take place in consideration of the CE identification and compliance with all applicable environmental stipulations.

THE REACTOR

The reactor is either a cylinder-type or for continuous process, a trough-shaped design, which is heated either electrically or with gas.

THE GAS DISTRIBUTOR PLATE

The proprietary gas distributor plate allows the optimal distribution of the process gases – even at highest temperatures – and a fluidization of the solids even at low gas velocities.

THE FILTER SYSTEM

The modern block back filter system retains fine particles. Metallic candle filter or cyclone are used.

THE PRODUCT DISCHARGE

The special product discharge guarantees the optimal emptying of the reactor without affecting fluidization.

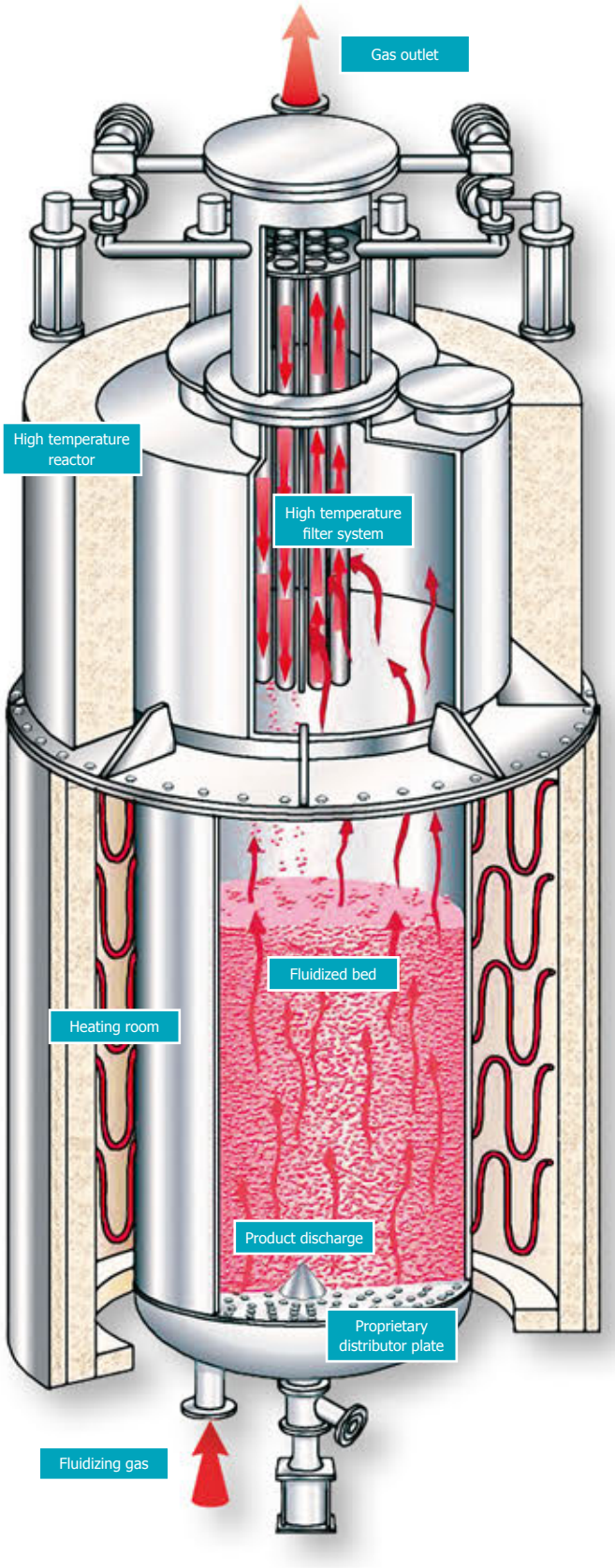


Fig. right:
Presentation of the gas flow through the solids inside a fluidized bed reactor. The gas is separated from the solids via the filter candles (blow back) and transported to the preparation unit.

APPLICATIONS UP TO 1100 °C

Based on over 40 years of development, experience and success, SCHWING manufactures specific high-temperature reactors based on the fluidized bed technology for the thermo-chemical treatment of powders with reaction gases in atmospheres up to 1100 °C. In addition to the typical applications such as

- oxidizing, reducing, calcining, tempering,
- gas/gas reactions, gas/solids reactions as well as
- coating and mixing processes,

new developments. In the surface modification of nano-scale powders and the use of various reaction gases open up many new applications.

The offerings of SCHWING range from conducting technical feasibility studies (fluidization tests, pilot trials in different dip and scale-up reactors) for product manufacturing and process development on pilot scale up to the delivery of complete systems for the continuous or intermittent operation.

Based on its comprehensive expertise in the area of high-temperature technologies SCHWING offers its customers worldwide know-how and thus competitive advantages.

Fig. left:
Flexible adjustment Scale-up reactor with fluid bed system (bottom) and filter system, etc. (top) for test series up to 120 liters at the SCHWING LAB+TECH CENTER, Germany.

PERFECTED TECHNOLOGY

The uniform distribution of the gas in the solids is the essential prerequisite for good fluidization. The greater the contact surface between gas and solid, the greater the benefit of the fluidized bed technology. Using the proprietary gas distribution plate from SCHWING, powders with different grain sizes can be superbly fluidized at low gas velocities.

The separation of the gases from the solids is just as important as the distribution of the gas in the solid. A special filter system specifically developed for this purpose ensures that even nano-scale particles remain in the reactor and do not need to be elaborately returned in the cycle via a cyclone. Using specifically suitable materials, the filter system works perfectly even in the high-temperature range. A sophisticated backflush system cleans the filter in alternating fashion from the solids attached on the outside.

The simplicity of the fluidized bed technology, combined with optimally dimensioned instruments and state-of-the-art measurement and control technology, not only ensure extremely easy operability of the systems but also the precise control and reproducibility of the thermo-chemical processes. Temperatures up to 1100 °C as well as the use of aggressive media are hereby possible.
The excellent materials and heat transmission properties of the SCHWING fluidized bed reactors and their compact design permit, in addition, energy savings up to 40% compared to conventional (rotary pipe) technologies.

THE BENEFITS

- Optimal heat transmission
- Superb heat distribution
- Maximum temperature accuracy
- Excellent mass transfer
- Short dwell times
- Simple system construction
- Low space demand
- Minimum energy usage
- Easy to operate

ULTIMATE EFFICIENCY

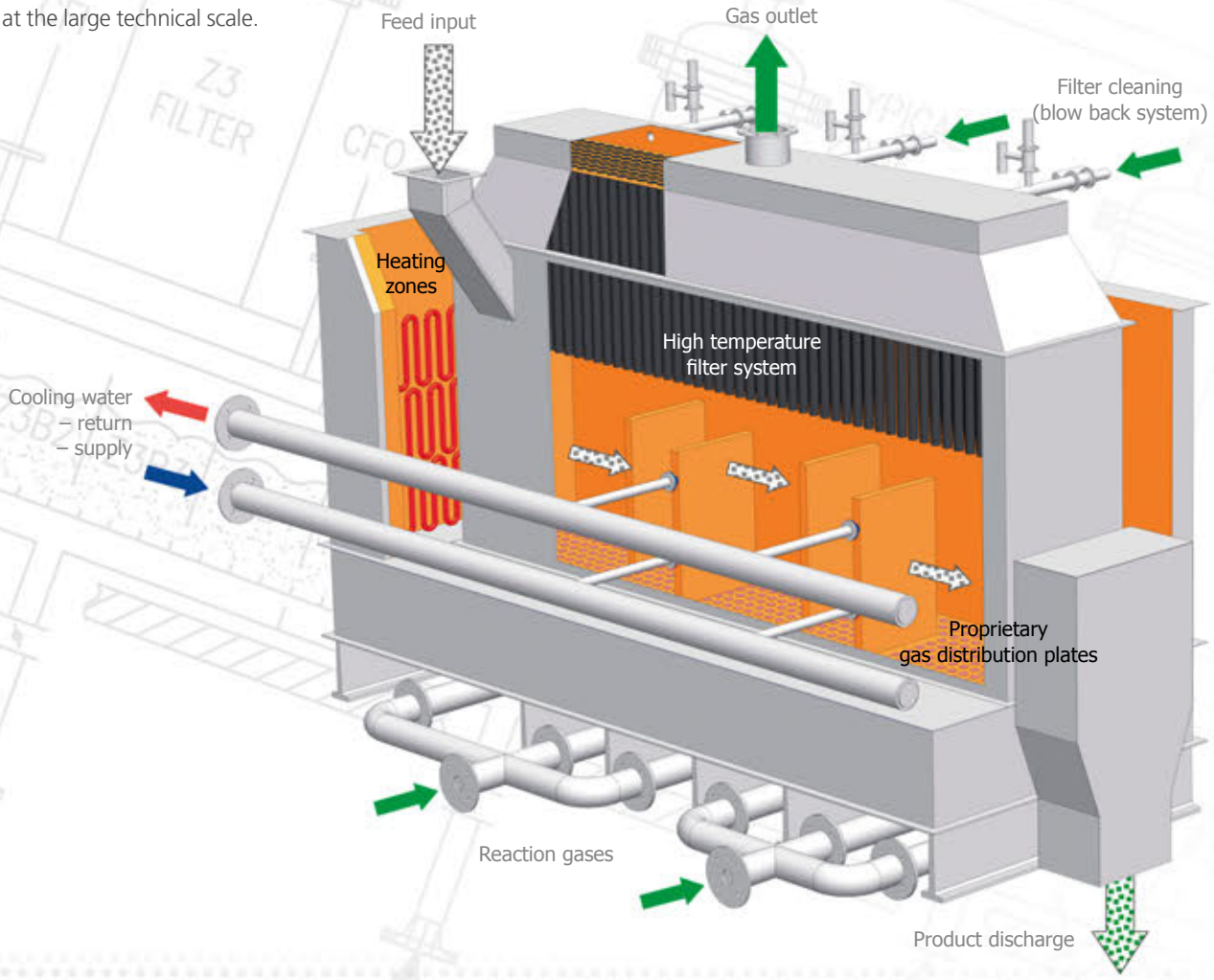
SCHWING develops, engineers and builds fluidized bed systems both at the bench scale and the production scale for batch and continuous operation.
Multistage fluidized bed reactors are used for the continuous execution of chemical reactions which are designed as multistage reactors also for calcining or drying powders or granulates with up to 150 theoretical mixing stages.

SCHWING LAB+TECH CENTER

The SCHWING LAB+TECH CENTER is located at the company's headquarters in Neukirchen-Vluyn (Germany). Customers and interested parties from diverse industries and countries here utilize the capability of testing the available technologies and processes and to run specific test series.
A variety of fluidized bed systems of different sizes and

Utilizing a special flow and dwell concept the multistage systems achieve a product uniformity so far reached only with batch operation. At the same time, the economic advantages of continuous processes can be fully utilized at the large technical scale.

design parameters is available here for the production of sample amounts up to one ton of material.



THE PROCEDURE

The successful employment or development of a high-performance fluidized bed reactor for process applications requires close cooperation between the system builder and the customer.
SCHWING offers a procedure proven particularly practical in innumerable test series and takes the specific requirements of the respective chemical process, the material properties and the required product parameters and quality grades into account.

1. „COLD" TRIAL PHASE

Optional in advance: Mutual confidentiality declaration

1. Online questionnaire for raw material, objectives, envisioned process conditions, etc.
2. Raw material will be supplied: approx. 4 liters of material powder incl. safety data sheets by customer
3. „Cold" fluidisation trials in lab unit to determine the fluidization parameters for the fluidized bed
4. Technical report with recommendations for „hot" fluidization trials

2. „HOT" TRIAL PHASE

5. Design meeting Determination of trial runs and process parameters, visit of lab and technical center facilities
6. Offer proposing the trial execution based on a test program / technical center trials / order placement
7. Technical center trials in DIP reactor (5-8 liters) in the presence of the customer, recording and documentation of all process data
8. Technical report and possibly initial cost planning of a production system

SCALE-UP PHASE

A. Offer proposing the trial execution based on a test program for scale-up trials / order placement
B. Process optimization and preparation of scale-up trials
C. Scale-up trials up to 120 liters in one of the pilot systems, batch or semi-continuous operation possible
D. Technical report Documentation of the scale-up trials

PRODUCTION PHASE

I. Determination of required system and process parameters and concept preparation for commercial system building
II. Contract production of a specific sample quantity after offer based on previous trials
III. Offer preparation for a commercial production system / order placement
IV. Engineering, system components, assembly (EPC) and startup

LAB REACTORS

The fluidized bed systems from the BSR model series from SCHWING constitute diverse high-temperature lab reactors for the treatment of nano-scale powders with reaction gases in atmospheres up to 1100 °C.

The BSR systems offer excellent heat and mass transfer properties at top temperature accuracy for typical applications such as

- calcining
- oxidizing / reducing
- tempering or
- surface modification through
- different reaction gases or
- mixes from several gases.

BSR MODEL SERIES

Principally, the design of the BSR lab reactors from SCHWING corresponds to the reactor construction shown on the opposite side. In addition, the BSR model series offers the following advantages:

- Mobile compact design, smallest footprint
- Gas velocities from 2 to 50 cm/s
- Temperature monitoring +/-2 °C at 1100 °C
- Can be used already from 1.5 liters useful volume
- Advanced, easy to operate process control

SCHWING TECHNOLOGIES

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