
X2000 SERIES GAS-PHASE REACTIONS



THE HIGH THROUGHPUT
EXPERIMENTATION
COMPANY



APPLICATIONS

- **Catalytic Naphtha Reforming**
- **Methane Activation**
- **Aromatics Conversion**
- **Isomerization**
- **Steam Reforming**
- **CO₂ Conversion**
- **Dehydrogenation**
- **(partial) Oxidation**

hte's X2000 is designed to bring parallel catalyst testing and optimization to a range of gas-phase chemistries.

It is optimized for high-temperature, low- and mid-pressure processes (sub-atmospheric possible) in up- and downstream applications, suitable for fast deactivating catalysts.

The system increases productivity in the evaluation of heterogeneous catalysts in fixed-bed reactions while delivering high-quality data.

BENEFITS

- Reliable, turnkey ready system following international industrial standards, developed over several years in hte's contract research programs.
- Complete lab-in-lab solution validated with your chemistry and immediately operational at your site.
- Proven, fully integrated workflow including on- and offline analytics, reactor loading, and data integration.
- Highly flexible system with online GC systems optimized for your application in high throughput experimentation.
- Sustainable investment covering a broad range of catalyst volumes from small amounts of powder to large amounts of shaped materials.

TECHNICAL FEATURES | X2000

Feed Section

- Mass-flow controlled dosing of feed gases. Total number of feed gases depending on customer requirement.
- Mass-flow controlled dosing of liquid feed, e.g. with Coriolis technology
- Dosing and evaporation of demanding liquid feeds
 - High-boiling liquids, e.g. Naphtha
 - Low-boiling liquids, e.g. liquefied gases (LPG)
 - Supercritical gases, e.g. CO₂
- Equal feed distribution in between reactors

Reactor Section

- Multi temperature zone oven to avoid cold spots, without time-consuming and erroneous usage of heat tapes, allowing easy access, e.g. during maintenance
- Four different temperatures among the 16 reactors, temperature difference between reactors < 1 °C
- Reactor temperature up to 900 °C
- Reactor pressure up to 100 barg
- High flexibility of reactor dimensions with various inner diameters suitable for reactor volumes within the isothermal zone up to 15 ml

Online Analytics

- High boiler traps to protect analytical equipment
- Active reactor off-gas measurement for mass balancing
- Online analysis, e.g. GC or IR for determination of hydrocarbons and permanent gases
- Highly efficient analytical methods optimized for measurement of high throughput experiments
- Usage of additional online analytical instruments to increase e.g. number of data points per time

Exhaust Treatment

- Vapour condensation module available
- Catalytic afterburner especially valuable for carcinogenic components, e.g. aromatics

Automatization

- hteControl™ for fully automated experiment control
- myhte™ for storage and processing of all data generated within the catalyst testing workflow

Safety

- Concept according to international standards (equipment and product safety legislation, CE)
- Designed for automated 24/7 operation with controlled shutdown
- Complete enclosure with sensors (LEL, TOX, Smoke, Exhaust Flow, etc.) as ready-to-use system (hte's lab-in-lab solution)

Engineering Services

- Engineering services under one roof from design, assembly, validation to delivery of the test rig
- Global one-year warranty and further customer care through our dedicated service group

Validation

- Fully validated ready-to-use system. Usage of high-quality parts from well-known manufacturers, e.g. Swagelok, Bronkhorst, Brooks, VICI, WIKA, Emerson, etc.
- Chemical validation at hte and at customer's site for FAT and SAT
- Dedicated training concept for unit operation

ENHANCEMENTS | X2000

- Advanced workflows and tools for faster and improved operation of the test rig
- Reactor loading workflow
- Offline data integration workflow
- Individual heaters for each reactor, for e.g. iso-conversion
- Status notification of test unit via mobile network, e.g. SMS, email
- Safe dosing of oxidizing and flammable gases for catalyst regeneration
- Sub atmospheric pressure down to 0.2 bar abs.
- Same time on stream module for rapid deactivating catalysts, guarantees that each catalyst is measured at the same TOS
- Measurement of catalyst bed temperature with thermo well
- Integration of FTIR, UV-VIS, MS, etc.
- Head pressure control, which assures a constant feed flow for each reactor in case of reactor blockage
- Reactor pressure from 0.2 bar abs. to 100 barg depending on application
- UL, NACE, Japanese High Pressure Gas Safety Act compliance, and many other certifications available

INFRASTRUCTURE REQUIREMENTS

Laboratory:

- Air-conditioned laboratory environment
- Floor loading capacity 500 kg/m²
- Typical footprint of test rig 5 m x 2.6 m x 1.5 m (WxHxD)
- Typical footprint of electrical cabinet 1.6 m x 2.3 m x 1 m (WxHxD)

Ventilation:

- Approx. 1,300 m³/h

Gas Supply (recommended):

- Feed gas with constant primary pressure (30 barg above reactor pressure)
- Analytical gas supply of 8 barg
- Instrument air of 6.5 barg

Power Supply:

- 230/400 VAC; 3-phase/neutral/PE; 5-wire system; other power supply, e.g. 110/208 VAC available upon request
- Energy demand approx. 10 kVA (stationary)
- UPS available

FOR BASIC TEST SYSTEM. FIGURES CAN VARY DEPENDING ON CUSTOMER REQUIREMENTS