

Altamira Series

- Automated Reactor Systems
- Temperature Programmed Reduction
- Temperature Programmed Oxidation
- Temperature Programmed Desorption
- Pulse Chemisorption
- Flow BET



**Catalyst Characterization
by Chemisorption**

AMI Chemi Family Overview

Overview

The AMI Chemi family of instruments combines a variety of temperature-programmed techniques, including: temperature-programmed desorption (TPD), temperature-programmed oxidation (TPO), temperature-programmed reduction (TPR), and temperature-programmed reaction (TPRx). The AMI Chemi family of instruments can also perform pulse chemisorption, dynamic BET, and gas-phase iso-thermal reaction experiments. The AMI family includes high-pressure instruments with the AMI-300HP; sulfur resistant models with

the AMI-300S, kinetic determining instrumentation with the AMI-300 SSITKA, and the new AMI-300ir for direct determination of adsorption/desorption surface process.

The leader in automated TPD/TPR/O/TPRx, and pulse chemisorption instruments since 1985, Altamira Instruments is the catalyst researcher's primary resource for automated catalyst test instruments and bench-scale reactor systems. The AMI series of instruments were the first fully automated chemisorption machines on the market.

AMI Family of Catalyst Characterization Instruments

AMI-300 Functions:

- Temperature Programmed Reduction
- Temperature Programmed Oxidation
- Temperature Programmed Desorption
- Pulse Chemisorption
- Flow BET

AMI-300

- "flagship" of the AMI family
- single station instrument with stand-alone PC and LabVIEW-based control software
- basis upon which the rest of the AMI-technology and software is based

AMI-300ir

- uses heated IR transmission cell coupled with an FTIR
- delivers real time information as to what is actually occurring on the surface of a catalyst

AMI-300IP

- two-workstation version wherein one station conducts pretreatment steps, while the second station performs a characterization experiment
- both workstations can run either a pretreatment step or a characterization experiment

AMI-300Lite

- entry-level version, which sheds some features of the AMI-300 like the saturator and gas blending as a concession to pricing
- operates on an unattended basis and performs all TPR, TPO, TPD, and Pulse Chemisorption functions

AMI-300R

- reaction version of the AMI-300
- equipped with additional gas feeds and HPLC pump(s) with vaporizer(s) to facilitate reaction studies.
- features an auxiliary vent to route reactant gases directly to a secondary detection device (e.g., RGA, GC, or MS)

AMI-3300

- three-workstation version of AMI-300
- provides all of the features of the AMI-300 instrument and can run three independent experiments simultaneously
- controlled via one single PC

AMI-3300Lite

- three-workstation version of the AMI-300Lite
- provides all features of the AMI-300Lite and can run three independent experiments simultaneously
- controlled via one single PC

AMI-300R (HP)

- custom high-pressure version of the AMI-300-R
- equipped to provide 100 bar (or more) of operating pressure during a reaction experiment

AMI-5300

- five-workstation version of the AMI-300, which can run five independent experiments simultaneously
- controlled via one or two PC's

AMI-5300Lite

- five-workstation version of the AMI-300Lite, which can run five independent experiments simultaneously
- controlled via one or two PC's

AMI-8300

- eight-workstation version of the AMI-300, which can run eight independent experiments simultaneously
- controlled via two PC's

AMI-8300Lite

- eight-workstation version of the AMI-300Lite, which can run eight independent experiments simultaneously
- controlled via two PC's

AMI-300 Chemisorption Analyzer



AMI-300

Perform dynamic temperature-programmed catalyst characterization experiments unattended with the latest generation fully automated chemisorption analyzer from Altamira Instruments. Determine metal dispersion, relative activity, adsorption strength, in one third the time of traditional volumetric methods. Analyze the off gas with the standard TCD or integrate a mass spectrometer or other detectors (FID, GC, FTIR) as options. Let us customize the instrument so you can, for example:

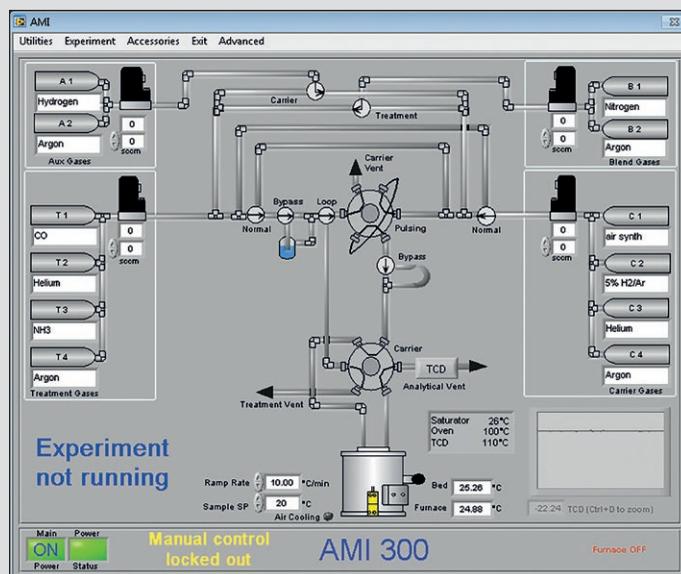
- Use it as an atmospheric reactor,
- carry out lengthy pre-treatments in a separate station,
- provide fast-switched feed compositions to mimic lean-rich burn scenarios,
- provide SSITKA capability.

Dynamic Chemisorption

The AMI-300 utilizes our proven technology for performing the following dynamic procedures:

- Temperature programmed desorption (TPD)
- Temperature programmed reduction/oxidation (TPR/O)
- Temperature programmed reaction (TPRx)
- Gas-phase isotherm reaction experiments (standard integrated gas-mixing)
- Pulse chemisorption
- Catalyst treatment
- Flow BET surface area
- Pulse calibration

Up to 99 procedures can be linked together consecutively to provide a complete characterization experiment. All experimental procedures can be designed and stored for easy retrieval.



Hardware and Operation

The AMI-300 is a fully automated catalyst characterization instrument wherein the LabVIEW-based software is used to switch gas streams, control gas flow rates, blend gases, control temperatures, control ramp rates, and to collect all the data needed to quantify the adsorption and desorption of gas molecules on the surface of a catalyst.

μBenchCAT Bench-top Reactor for Catalytic Studies

μBenchCAT

The μBenchCAT by Altamira Instruments represents a complete, bench-top reactor for catalytic studies. All the components required for either gas-phase or liquid-phase reaction studies are contained in a fully automated compact package. A variety of options makes the μBenchCAT suitable for a wide range of studies.

Hardware

Reactor Feed: Up to 6 gases and 2 liquids can be used in the standard configuration of the μBenchCAT. Each gas train incorporates a filter, electronic mass flow controller (MFC), check valve, and positive shut-off valve. The range and gas calibration of each MFC is specified by the customer. Liquids are delivered using high precision HPLC pumps.

Condenser: A tube-in-tube condenser is located outside the oven at the outlet of the reactor. A thermocouple is used to monitor the coolant return.

Gas/Liquid Separator: The gas/liquid separator is found downstream of the condenser. Two level switches (high and low) activate an automatic valve and serve to maintain level control.

Pressure Control: Exit pressure is measured with a separate pressure transducer and the pressure is controlled using an automatic tapered needle valve.



Product Sampling Valve: An optional product sampling valve can be used to route an effluent sample to an external analytical device.

Heated Oven: Most process components are housed inside an isothermal oven operated at up to 200 °C. The following components are found in the heated oven:

- Integral gas preheater and liquid preheater/vaporizer operating at up to 300 °C
- Feed mixer
- Reactor by-pass valves
- Reactor furnace with measuring and safety-switch thermocouples
- Reactor with internal thermocouple
- Pressure transducer isolator
- Lines leading to pressure transducer and pressure relief valve mounted outside the oven

System Features	
Maximum Operating Temperature	650 °C or 1,200 °C, depending on reactor material
Maximum Operating Pressure	Atmospheric, 30 bar, or 100 bar (higher pressures available)
Number of Gas Feeds	Up to 6
Number of Liquid Feeds	0, 1, or 2
Reactor Material	Stainless Steel, Quartz, or Incoloy
Wetted Materials Include	Stainless Steel, PEEK, Kalrez, Viton, Incoloy, and Quartz
Other Features	<ul style="list-style-type: none">■ Isothermal oven housing most process components■ Full automation of process using LabVIEW■ Redundant safety thermocouples■ Slip-stream sampling (optional)
Connection to External Detectors	The product effluent can be directed to an external detector, such as a gas chromatograph, via an optional heated or unheated sampling valve.

BenchCAT Customized Reactor Systems

BenchCAT

The BenchCAT family of instruments are custom-designed microreactors, which are fully automated and designed for unattended operation. All BenchCATs are designed around: number of gas inlets, number of liquid pumps, flow rates, pressure and temperature maximums, reactor material, preference of control software, future upgrade possibilities, etc. BenchCAT microreactors can be designed to conduct iso-thermal or temperature-programmed experiments and analyze the effluent with a mass spectrometer, gas chromatograph, FTIR, or your choice of detector. Single or multi-station instruments are available. Microreactors built specifically for biofuel applications are also part of this line of instruments.

Applications

- Hydrocarbon hydrogenation
- Studies of gas-phase reactions, such as methanol to formaldehyde
- Ethylbenzene dehydrogenation
- Biofuel studies

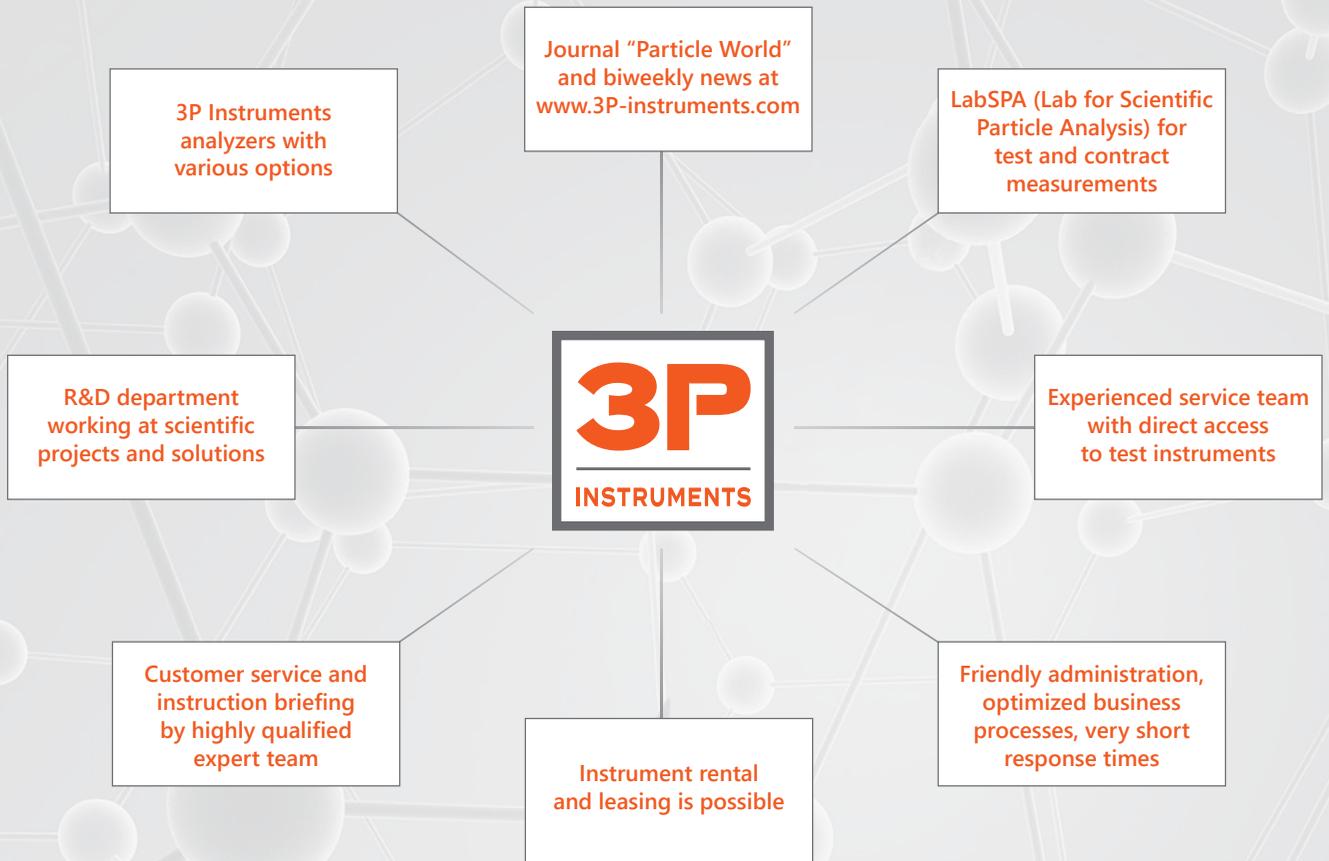


BenchCAT 1000R HP – Studies of Hydrocarbon Hydrogenation

This unit consists of one fixed bed reactor for a gas phase hydrogenation reaction. The feed module can deliver three gases and one liquid. The reactor tube is stainless steel and can operate at temperatures up to 600 °C at 100 atmospheres. The reactor module uses a three-zone furnace and the flow can be operated in an up-flow or down-flow configuration. The reactor effluent is routed to a gas/liquid separator where analysis can occur. Safety features include a hydrocarbon detector integrated into the computer software prompting error messages, alarms, or automatic shutdown.

Your partner in particle characterization

3P Instruments has over 30 years of profound expertise in the characterization of emulsions and dispersions, of particles and powders as well as surfaces and pores.



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AMI series



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