TECHNICAL SPECIFICATION

FOR:

AMI-300Lite

ECONOMIC DYNAMIC CHEMISORPTION ANALYZER

Revision 0

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PREPARED BY:

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1. Basic System Specifications

System Operating Pressure	ambient
Gas Inlet Pressure Range	40-60 psig
Maximum Furnace Temperature	1000°C (Option for 1200°C); 50°C/min max
Maximum TCD Temperature	200°C
Mass Flow Controller Flow Range	0-50 Sccm (standard); can be modified
Materials of Construction	
Plumbing	316SS
Sample U-tubes	Quartz
Wetted parts	316 Stainless Steel
Catalyst Charge	0.1- 1 gm (different u-tubes)
No. of Gas Ports	5
Power Supply	
Hardware Cabinet	220 / 20 A; single phase
Computer	220 / 15 A; single phase
Dimensions	
Hardware Cabinet	64cm W x 64 cm H x 64 cm D

2. Procedures

The AMI-300Lite system is designed to perform the following characterization experiments:

- Temperature Programmed Reduction (TPR)
- Temperature Programmed Oxidation (TPO)
- Temperature Programmed Desorption (TPD)
- Temperature Programmed Reaction
- Pulse Chemisorption plus Pulse Calibration
- Single Point BET

3. Gas Feed

The simplified flow scheme used on the AMI-300Lite requires only one mass flow controller for monitoring and regulating gas flows and is shared by both treatment and carrier gases. Mass flow control allows precise control of the selected gases at the operating temperature and 0-50 sccm flow range (other ranges available). Mass flow controller set point and readout are shown on the PC monitor. There are 5 gas inlet ports shared by treatment and carrier gases. In order to avoid cross-contamination, port 5 is designated as inert.

4. Heater and Sample Reactor

The AMI-300Lite utilizes a highly efficient compact heater design, its maximum temperature is 1000°C. The temperature is controlled through a software-controlled independent PID loop. Sample U-tubes can easily be installed and removed.

The sample station is located near the center front of the instrument. Quartz sample U-tubes are held in place by Ultra-torr® compression fittings.

5. Thermocouples

Two type-K thermocouples are fixed to the heater. One thermocouple feeds the heater over-temperature switch. The second thermocouple serves as the control for the PID control loop.

6. Thermal Conductivity Detector

Uses a high quality 4-filament TCD, with high resolution, linearity, accuracy and stability. Standard filament material is tungsten. Other filament materials are available.

7. Computer Control

The system is controlled by a computer, which controls and monitors process parameters, acquires data in real time, monitors alarms and takes proper action, trends both real time and historical data, and generates reports and graphs. The computer comes fully installed with a Windows based operating system. Minimum specifications are:

- PC Processor: 3.00 GHz
- Operating System: Windows
- Hard Drive: 200.0 GB
- Monitor: 17”
- RAM 3 GB

8. Software Features

The software is based on LabVIEW Real-Time for Windows and is configured by Altamira Instruments to the specific I/O of the reactor system. The configuration for basic operation of the unit includes the following features or more if required:

- Manual operation (operator flow schematic screen)
- Real time data trending
- Historical data trending
- Gas and PID calibrations
- Signal filtering
- Alarm history windows
- Creation, storing, and recalling a set of experimental actions
- Data storage and records of selected parameters, process data, and alarms
- Multitasking capability

The Altamira Analysis software provides post-processing of experimental data generated by the control system. Extensive signal processing and report generation features are incorporated.

- Seamlessly import and “zip” archived data generated by control software
- Enhanced report generation capabilities
- “Drag and drop” base-lining, signal smoothing, and numeric integration
- Descriptive calculations including uptake, % dispersion, % consumption and more
- Apply signal transformations including scaling, time-shifts, and dependent offsets
- View pulse data in sequential or overlay mode
- Manually adjustable and automatic peak fitting

- Export signals as text tab-delimited files compatible with other processing and report software

9. Safety Features

A number of features have been incorporated into the design of the AMI-300Lite Catalyst Characterization System to ensure safe operation:

1) Hardware over-temperature protector for the furnace is located in the control drawer.

2) Pressure relief valve on reactor

3) All process equipment operated by a power source are equipped with fuses

4) Software-coded safety backups configured by Altamira Instruments.

10. Acceptance Procedure

Client will formally accept the instrument and release any retention amounts after the instrument is installed. This procedure will ensure the instrument:

- Flow paths are correctly plumbed;
- All valves work properly;
- TCD operates properly;
- Mass flow controller works properly;
- Furnace ramps the temperature in a linear fashion and maintains a stable hold at the end of the ramp;
- A single Temperature Programmed Reduction (TPR)

11. Options

11.1 **Sub-ambient Option -** Supports operation at –130ºC: The sub-ambient option consists of a liquid nitrogen dewar, a flexible stainless steel hose that connects to the sample holder, and a Teflon hose that connects to a solenoid valve inside the AMI instrument. Nitrogen gas is supplied to the solenoid and through the dewar filled with liquid nitrogen. This cooled gas is then fed to a special sub-ambient sample holder, which provides a jacket around the reactor tube. When the AMI software is set for a temperature below the standard room temperature of 25ºC, the valve supplies nitrogen to the dewar. This cooled nitrogen proceeds to the jacket to achieve the desired temperature. Temperature ramping is linear from –130ºC to 1000ºC

11.2 **Mass Spectrometer Option**: The mass spectrometer with an enclosed ion source provides supplementary analytical capability, aiding in the identification of materials generated while performing analysis in the AMI. A dry pumping system prevents any additional hydrocarbons originating from pump oils from getting into the system and providing false hydrocarbon indications. The mass spectrometer can have mass ranges of up to 100, 200, and 300 AMU's and a capillary heater is provided to prevent condensation. The software displays the plots of mass numbers along with the TCD data to allow better interpretation of results.

11.3 Second MFC Option: The second MFC option consists of an additional mass flow controller, a filter, and a check valve. The option permits two gases to be blended together on the carrier side.

11.4 IR Option: Consists of an IR transmission cell, heaters, and FTIR for real-time observation of the catalyst surface. Maximum temperature (in argon-rich atmosphere) is 500°C. The IR option aids in the determination of the mode/type of adsorption.

11.5 Pretreatment Option: Consists of a pre-treatment station that allows the user to conduct a treatment up to 400°C with inert gas at the same time as the other station conducts an analysis. Heating is accomplished with a mantle heater.

12. SEAL MATERIALS

The chemical compatibility chart below can be used to determine, which seal material will work best with your applications.

Chemicals	Viton	Buna-N	Premium
Acetone	Do Not Use	Do Not Use	Excellent
Acids			
Chromic	Excellent	Do Not Use	Excellent
Hydrochloric	Excellent	Do Not Use	Excellent
Hydrofluoric	Excellent	Do Not Use	Excellent
Nitric	Excellent	Do Not Use	Excellent
Phosphoric	Excellent	Do Not Use	Excellent
Sulfuric	Excellent	Do Not Use	Excellent
Amines	Do Not Use	Do Not Use	Excellent
Diethylamine	Do Not Use	Poor	Excellent
Ammonia			
10%	Do Not Use	Excellent	Excellent
Anhydrous	Do Not Use	Good	Excellent
Benzene	Good	Do Not Use	Excellent
Carbon Dioxide	Good	Excellent	Excellent
Hydrocarbons			
Aromatic	Excellent	Poor	Excellent
Naphtha	Excellent	Poor	Excellent
Nitrous Oxides			
Pyridine	Do Not Use	Do Not Use	Excellent/Good
Sulfur Materials			
Hydrogen Sulfide	Do Not Use	Do Not Use	Excellent/Good
Sulfates (SOx)	Excellent	Do Not Use	Excellent
Water			
Steam	Do Not Use	Excellent	Excellent

Premium seals include parts constructed of the following materials: Perlast, Kalrez, Kel-F, PEEK, Teflon, Tefzel, and EPDM.