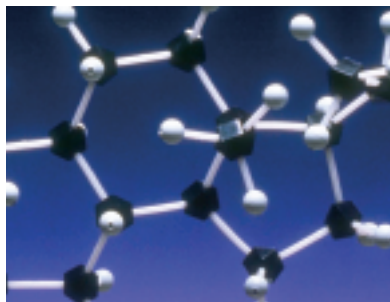


The TPDRO 1100 is a new concept instrument designed for the characterization of heterogeneous supported catalysts and reactive solids. TPDRO 1100 offers full automation by absolute computer control and high accuracy detection. It is the ideal solution for quality control and research applications.

TPDRO 1100

for temperature programmed desorption, reduction, oxidation and pulse chemisorption



The most common measurements for catalysts characterization as TPD, TPR, TPO and pulse chemisorption are now easy to be performed and completely unattended by the new TPDRO 1100. The detector is a TCD type, which makes this instrument extremely sensitive, providing the solution for a large range of linearity. The TPDRO can automatically perform sample pretreatment simultaneously to the analysis on two separate and independent ports.

Thanks to the new designed sample holder, the user can perform suitable catalyst activation in the preparation position while the analysis on a different sample is running. The software runs under Windows 2000/XP and features a useful mix of different databases for samples, gases, metals, reactions, analytical methods, calibration run, etc.

Product Specifications TPDRO 1100

Mode of operation

Parallel (two reactors): two independent sample positions (two ovens), for catalyst activation (pre-treatment) and for analysis (TPD, TPR, TPO or pulse chemisorption). The two positions are interchangeable.

Sequential (one reactor): unlimited and unattended sequence of operations are possible on a single reactor (i.e. multiple reduction, oxidation, chemisorption, desorption, etc.)

Reactor

Type: special design tubular flow-through quartz reactor for powders and pellets (maximum diameter about 0.9 cm). A special 4 way valve permits to insulate the catalyst from the environment and to transport the reactor filled with an inert gas

Sample activation circuit

Temperature range: from room temperature to 1100 °C (steps of 1 °C)

Temperature rate: from 1 to about 40 °C/min (steps of 1 °C/min)

Max cooling time: about 35 minutes from 1100 °C to room temperature (needs connection to compressed air, total time depends on compressed air temperature, starting and final temperatures)

Gas carrier ports: 3 separate gas ports automatically selected (one for inert gas)

Carrier type: H₂, O₂, CO, He, N₂, Ar, Air, etc.

Flow control: electronic flow controller

Flow rate: from 10 to 200 cc/min (H₂), steps of 1 cc/min

Inlet pressure: 100 KPa

Analysis circuit for TPD/TPR/TPO

Temperature range: from room temperature to 1100 °C (steps of 1 °C)

Temperature increase rate: 1 to 40 °C/min up to 750 °C and 1 to 20 °C/min up to 1100 °C (steps of 1 °C/min)

Temperature decrease rate: -1 to -40 °C/min from 1100 °C (steps of -1 °C/min) to room temperature (temperature rate is linear down to 100 °C)

Max cooling time: about 35 minutes from 1100 °C to room temperature (needs connection to compressed air, total time depends on compressed air temperature, starting and final temperatures)

Sample temperature: measured inside the catalyst bed by a type K thermocouple (Cr/Al) protected by a quartz shield

Gas carrier ports: 4 separate gas ports automatically selected (two for inert gases)

Carrier type: He, N₂, Ar, CO₂, mixed reactive gases (i.e. H₂ in Ar, O₂ in He), etc.

Flow control: mass flow controller

Flow rate: from 10 to 100 cc/min. (N₂), steps of 1 cc/min

Inlet pressure: 100 KPa

Analysis circuit for Pulse Chemisorption

Temperature range: selectable from room temperature to 1100 °C, steps of 1 °C

Extended temperature range: liquid circulation special container can be connected to a suitable thermo-regulation bath (not supplied with the instrument) for analyses performed below room temperature. Temperature range is determined by the external device and the cooling fluid

Temperature rate: not applicable, works in isothermal conditions

Cooling time: about 35 minutes from 1100 °C to room temperature (needs connection to compressed air, total time depends on compressed air temperature, starting and final temperatures)

Sample temperature: measured inside the catalyst bed by a type K thermocouple (Cr/Al) protected by a quartz shield

Pulse gas loop flow: fixed, about 30 cc/min

Pulse gas type: H₂, O₂, CO₂, CO, air, mixed gases (i.e. H₂ in Ar, O₂ in He), vapors mixed in He, light corrosive gases (i.e. NH₃ in He)

Flow control: by a restriction

Inlet pressure: 100 KPa

Injection pressure : atmospheric pressure

Loop volume : customizable from about 0.15 cc up to 2 cc



Product Specifications TPDR0 1100

Available traps for gases vapours

Filter:	a filter container is placed before the TCD detector to stop vapours or undesirable gases. Available adsorbents are soda lime, molecular sieve and magnesium perchlorate
Cold trap:	placed before the TCD detector, the cold trap can be filled with a suitable fluid to condensate undesirable vapours

Built-in detector

Type:	thermal-conductivity detector (TCD) four filaments in a diffusion cell
Signal output:	0-10 volt (available gain X1 or X10)
Resolution:	0.1 mV
Filaments type:	tungsten

Data acquisition

Capacity:	maximum of 2 instruments can be connected to the same data station
Interface:	16 bits A/D converter card, total of 16 independent analog input channels
Communication port to computer:	RS232
Software:	dedicated software for instrument control, data acquisition, data processing and analytical results reporting by Windows 2000/XP based software

Physical

Weight:	80 kg (packed 100 kg)
Dimensions:	765 x 480 x 530 mm (w x d x h)
Power supply:	220 V (+/- 10 %) , 50/60 Hz, 1100 VA
Environment:	15 - 35 °C, 30 - 85 % RH

Options

Vapour generation kit (VapGen Kit)

	To be used for the Pulse gas line. Vapours from organic liquids is generated as a mixture in helium. Vapour percentage in the stream depends on the temperature at which the liquid is maintained (by an external fluid circulation bath, not enclosed in the kit). Works at room temperature or below.
Organic liquids:	all organic liquid showing a vapour pressure above 20 torr at 25 °C
Vapour temperature probe:	thermocouple type K placed inside the VapGen directly connected to the TPDR0 software for vapour pressure calculation
Liquid temperature control:	any external fluid circulation bath generating temperatures between 0 °C and room temperature (not enclosed in the kit)
Vapour percentage range:	depends on the organic liquid vapour pressure and the temperature setup

External detector

Mass spectrometer:	any suitable mass spectrometer can be easily connected in series to the TCD for a better analytical comprehension of the evolving gases
--------------------	---

parallel is faster than serial !



Software features TPDRO 1100

Instrument control	Complete and simultaneous instrument control for sample activation (pre-treatment) and analysis. Data displayed on graph in real time (TCD signal, sample temperature, oven temperature). Parameters displayed in real time (gas flow for preparation and analysis, actual phase, temperature rates, sample name, etc.) Software can control up to 2 instruments connected to the same computer
Built-in databases	Metals and metal oxides, pure gases and mixtures coefficients for mass flow controllers, vapours Antoine coefficients, stoichiometry factors for chemical reactions, analytical methods for TPD/TPR/TPO/Pulse, preparation methods, catalyst and samples database, quantitative calibration factors
Available graphs	TCD (mV) versus time, TCD (mV/g) versus time, sample and oven temperatures versus time, TCD (mV) versus temperature, TCD (mV/g) versus temperature, graph for desorption activation energy Overlay function of all the graphs type (number of experiments is limited by the computer memory capacity). Link function of sequential experiments on the same graph for both TCD and temperature signals
Built-in integration	Automatic or manual: baseline subtraction, peaks integration limits, peaks addition or removal Display of peak temperature, peak retention time, peak signal (mV), integral value (mV.sec, mV.sec/g)
Data reporting	Performed by Microsoft Word or in RTF format. Function for copy and paste the displayed graph
Data storage	Raw data text files can be directly imported in Microsoft Excel
Calculations	Amount of reactive gas adsorbed or desorbed ($\mu\text{mole/g}$), amount of metal reacted ($\mu\text{mole/g}$), metal dispersion (%), metal specific surface area (m^2/g), mean metal aggregate size (nm), activation energy for desorption (KJ/mole)