



TA INSTRUMENTS

Thermal Analysis



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DIFFERENTIAL SCANNING CALORIMETRY

Q2000	3
Technical Specifications	4
Q200	5
Technical Specifications	6
Q20	7
Technical Specifications	8
DSC Technology	9
Accessories	11
Temperature Control Options	17
Tzero Technology	21
MDSC Technology	25
Applications	27

THERMOGRAVIMETRIC ANALYSIS

Q5000IR	35
Technical Specifications	36
Q500	37
Technical Specifications	38
Q50	39
Technical Specifications	40
Q5000IR Technology	41
Q500 / Q50 Technology	47
TGA Accessories & Options	49
Applications	55

VAPOR SORPTION

Q5000SA	65
Technical Specifications	66
Q5000SA Technology	69
Applications	73

SIMULTANEOUS DSC/TGA

Q600	77
Technical Specifications	78
SDT Technology	79
Applications	81

DYNAMIC MECHANICAL ANALYSIS

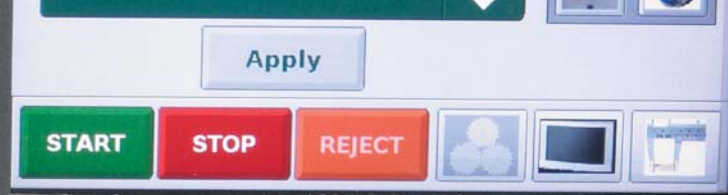
Q800	85
Technical Specifications	86
RSA III	87
Technical Specifications	88
Deformation Modes & Sample Size	89
Modes of Operation	90
Q800 Technology	91
RSA III Technology	93
Modes of Deformation	95
Accessories	97
DMA Theory	98
Applications	99

THERMOMECHANICAL ANALYSIS

Q400EM / Q400	105
Technical Specifications	106
Q400 Technology	107
Modes of Deformation	109
TMA Theory / Modes of Operation	111
Applications	115

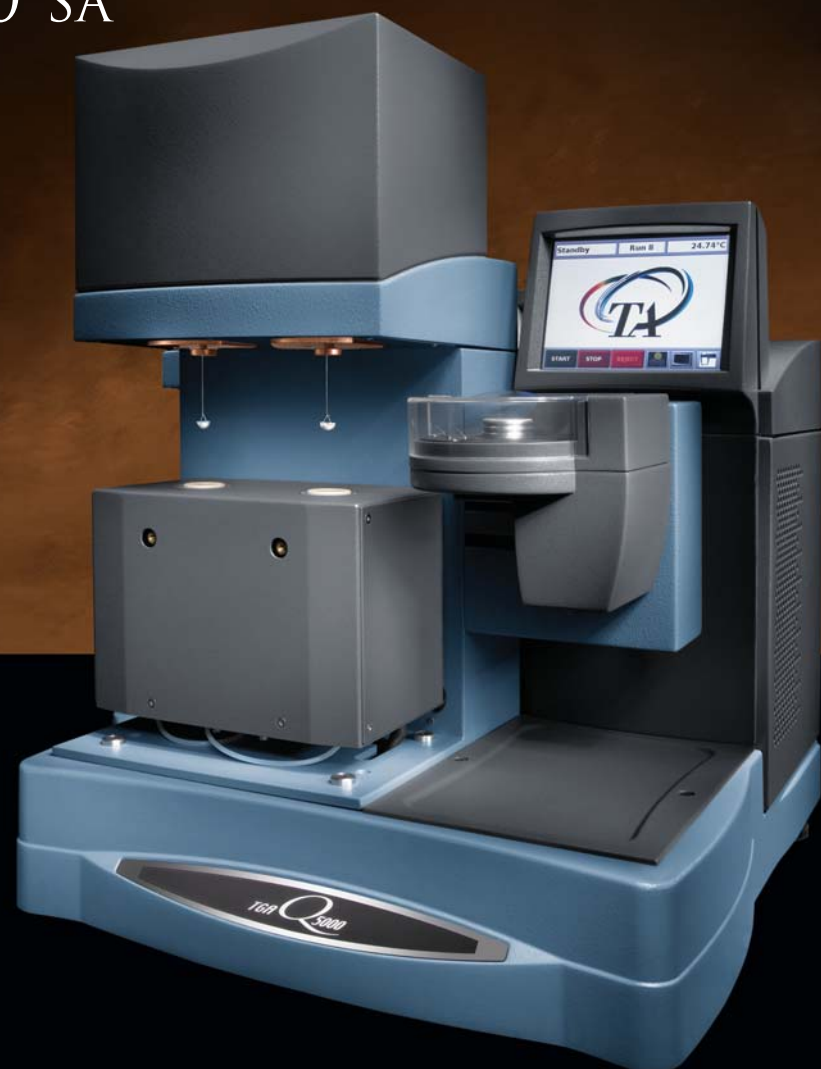


Q5000SA



Vapor Sorption

Q5000 SA



The Q5000 SA is designed for manual or automated sorption analysis of materials under controlled conditions of temperature and relative humidity (RH). Its design integrates our latest high sensitivity, temperature-controlled thermobalance with an innovative humidity generation system, multi-position autosampler, and powerful Advantage™ software with technique specific programs and Platinum™ features. The patented Q5000 SA delivers the performance and reliability required in a leading sorption analyzer and in a compact, user-friendly design.

TECHNICAL SPECIFICATIONS

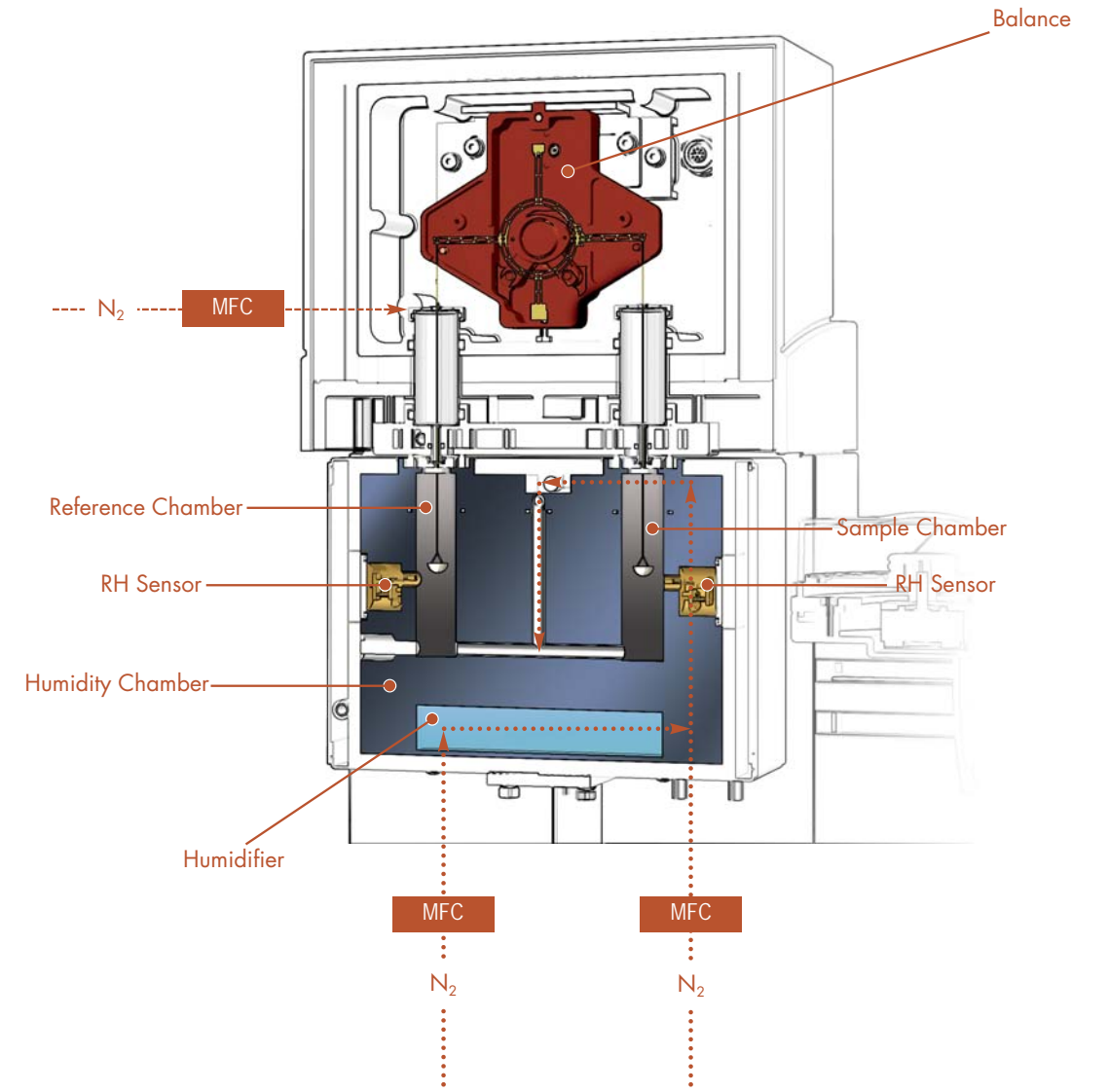
Temperature Controlled Thermobalance	Included
Dynamic Range	100 mg
Weighing Accuracy	+/- 0.1%
Weighing Precision	+/- 0.01%
Sensitivity	< 0.1 µg
Baseline Drift*	< 5 µg
Signal Resolution	0.01 µg
Temperature Control	Peltier Elements
Temperature Range	5 to 85 °C
Isothermal Stability	+/- 0.1 °C
Relative Humidity Control Range	0 to 98 %RH
Accuracy	+/- 1 % RH
Autosampler – 10 samples**	Included
Platinum™ Software	Included
Sample Pans	Metal Coated Quartz 180 µL Platinum 50, 100 µL Aluminum Sealed Pan 20 µL

* Over 24 hours at 25 °C and 20 % RH with empty metal coated quartz pans

** Optional tray accommodates 25 samples for use with platinum and sealed aluminum pans

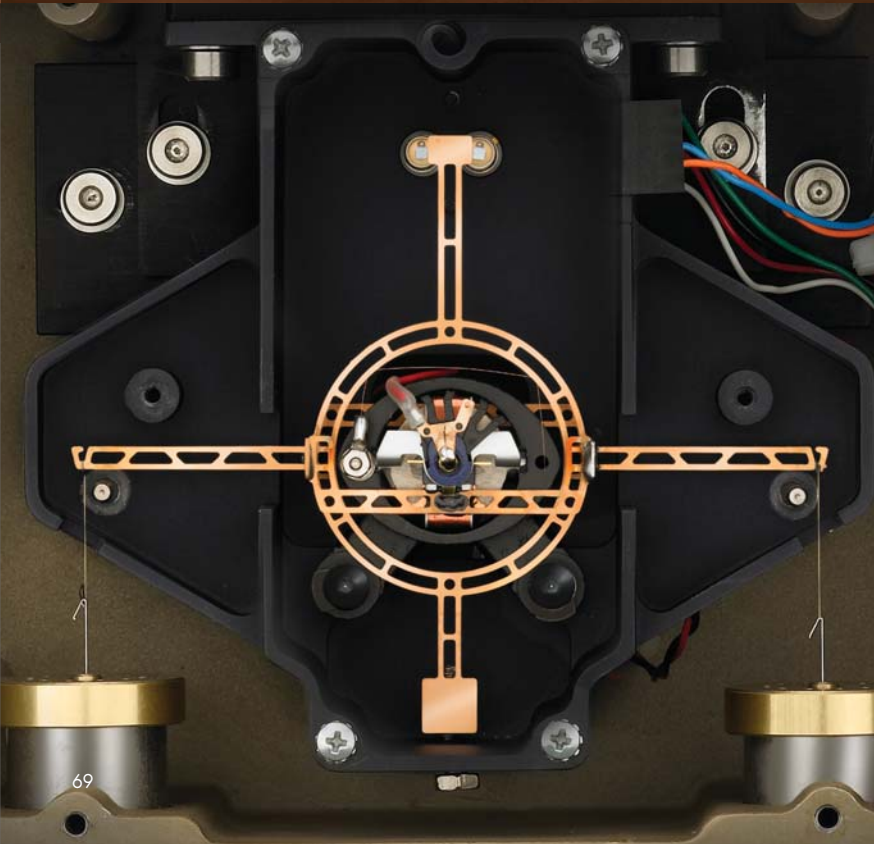
HUMIDITY CONTROL CHAMBER

The patented design features a pair of mass flow controllers (MFCs) that accurately meter and proportion gas to a symmetrical, well-insulated, aluminum block. The block contains a humidifier, gas transmission and mixing lines, plus easily accessible, identically arranged, sample and reference measurement chambers. Temperature regulation of the block interior from 10 to 85 °C is performed by four thermoelectric (Peltier) devices in conjunction with a thermistor in a closed-loop system. The mass flow controllers adjust the amounts of wet (saturated) and dry gas to obtain humidities from 0 to 98 %RH. Identical sensors are located adjacent to the sample and reference crucibles, and provide a continuous indication of humidity. Benefits of the design include precise temperature control and highly consistent atmosphere within the sample and reference chambers.



Q5000 SA TECHNOLOGY

The Q5000 SA is a compact, benchtop instrument that delivers the performance and reliability required in a leading sorption analyzer designed for the study of materials under controlled conditions of temperature and relative humidity. Its modern, user-friendly design features a high sensitivity, temperature-controlled thermobalance, an innovative humidity generation system, a 10-position autosampler, and our latest Advantage™ software with Platinum™ features.



THERMOBALANCE

The heart of the Q5000 SA is our latest high performance thermobalance maintained at a constant 35.00 °C by three symmetrically arranged heaters in a well-insulated, gas purged chamber. Isolated from the furnace by a water-cooled plate, the sensitive, null-balance design features the latest in precision weighing technology. A key feature of the design for sorption analysis operation is the perfect symmetry of the balance assembly. Customer benefits of the patented design include sensitive, reliable operation with superior baseline flatness and exceptional accuracy and precision in weight change detection; factors that are critical for proper gravimetric sorption analysis performance and are totally free from any vapor condensation or electrostatic forces.



AUTOSAMPLER

The integral Q5000 SA Autosampler features a programmable multi-position sample carousel that permits automated analysis of up to 10 samples using semi-spherical quartz (or metal-coated quartz) crucibles, and 25 samples using the optional Q5000 IR tray and platinum or sealed aluminum pans. The design provides smooth and efficient loading and unloading of the sample pan without disturbing the balance. All aspects of sample testing are automated and software controlled, including pan taring and loading, sample weighing, autosampler movement, furnace movement, pan unloading and furnace cooling. Autosampler productivity is software maximized by our Advantage™ software, which provides pre-programmed analysis, comparison, and presentation of results.

GRAVIMETRIC VAPOR SORPTION ANALYSIS — GENERAL PRACTICE

Moisture Sorption analysis is an established technique for determining the effect on materials of exposure to controlled conditions of temperature and humidity. Isotherm and Isohume experiments are the most commonly performed analyses.

In isotherm experiments, a weighed sample is “dried” externally (or preferably in the instrument) and exposed to a series of humidity step changes at constant temperature. The sample is held at each humidity level until no further weight change is detected or a set time has elapsed. A data point is recorded, the humidity is changed in controlled RH steps and the process repeated in an increasing or decreasing procedure. Isohume experiments involve a series of temperature step changes at constant humidity and result in similar plots. They are used to determine how sample exposure to a given humidity results in a physiochemical change, such as a change in the sample’s hydration state. The curve shape provides useful information to this end.

The Q5000 SA analysis software offers Sorption Analysis, BET Analysis, and GAB programs. In addition, the full power and flexibility of our renowned Universal Analysis software provides for easy data manipulation, advanced reporting, plotting and file exporting capabilities. Platinum™ control software provides for several new user convenience features such as system diagnostics, e-mail results notification and web-mail update notification of new software features.

The Q5000 SA is factory calibrated for temperature and humidity. Certified deliquescence salts (e.g., NaCl, NaBr) are widely accepted as standards for periodic verification of system performance. TA Instruments Platinum™ Software with scheduling and autoanalysis features simplifies the verification process.

Q5000 SA

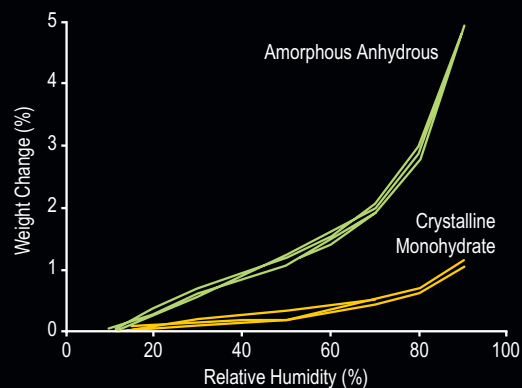
Semispherical metal-coated quartz crucibles (180 µL) and optional platinum (50 and 100 µL) TGA pans are available for use with the Q5000 SA. The former are commonly used in sorption analysis because of their anti-static capabilities, chemical inertness and ease of cleaning, while Platinum pans are generic for TGA analysis of most materials. Sealed aluminum pans are also an option for ensuring the integrity of materials which readily adsorb moisture or lose volatiles.



APPLICATIONS

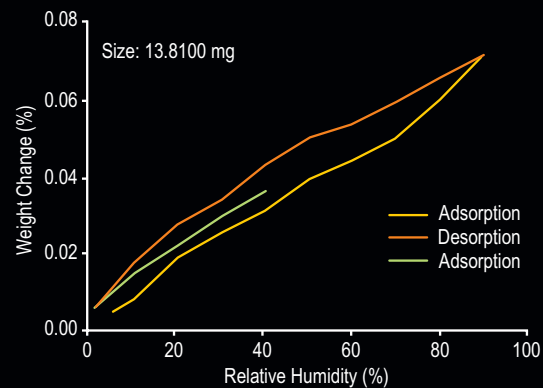
EVALUATION OF AMORPHOUS STRUCTURE

Pharmaceutical scientists are often interested in determining the amount of amorphous material in a drug formulation. As the amorphous and crystalline forms are chemically identical, classical analysis techniques are often insensitive to amorphous content. The figure below shows the moisture sorption analysis of a generic drug in its amorphous and crystalline forms. As the amorphous form absorbs significantly more water, the Q5000 SA can be used to quantify relative amorphous content in drug mixtures.



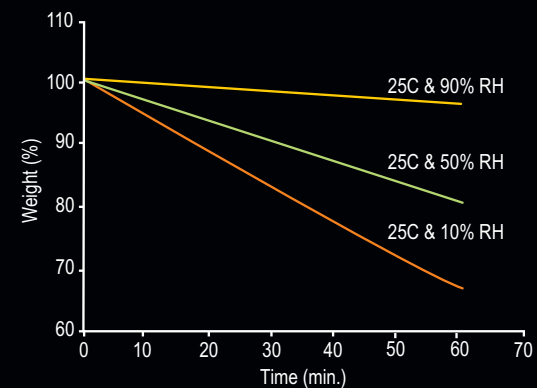
ANALYZING SMALL AMOUNTS OF PHARMACEUTICALS

When evaluating pharmaceuticals it is common for only small amounts of material to be available for conducting multiple analytical tests. Hence, the ability to work with small samples is critical. The low baseline drift of the Q5000 SA means that good results can be obtained on even 10-20 milligrams of crystalline drugs such as prednisone, which adsorbs <0.1% moisture over a broad humidity range. The sorption results shown below represent about 15 micrograms of weight change full-scale. The reversibility (lack of hysteresis) in the sorption/desorption profile for prednisone (as well as the low level of moisture adsorbed) indicates that the moisture picked up by the material is adsorbed on the surface of the material rather than being absorbed into its structure.



OPTIMIZING DRYING CONDITIONS: LATEX PAINT

Drying of paints is a process that is strongly affected by the temperature and humidity of the environment where the paint is being used. The Q5000 SA with sealed/punched pans is an excellent way to study and compare different situations on a given paint formulation. The figure below contains the data from the drying of latex paint at 25°C, and 10%, 50% or 90% relative humidity. From the data below, it is clear that the relative humidity dramatically influences the rate of drying. After 60 minutes, the sample at 10% RH has lost nearly 33% of its initial mass, whereas the sample at 90% RH has lost only about 4%. Obviously, the sample at 90% RH would still be considered "Wet Paint" after one hour.



EVALUATION OF HYGROSCOPIC MATERIALS: ZEOLITE CATALYST

Porous materials such as zeolites tend to pick up water through both an "absorption" (molecules taken up by the volume) and "adsorption" (molecules taken up by the surface). The difference in sorption mechanism is often a function of the pore size. Below contains the sorption analysis of a zeolite material. The absence of hysteresis on increasing and decreasing the % RH, as well as the relatively small amount of water taken up suggests that this particular zeolite is undergoing adsorption. This could be indicative of the relative pore size distribution.

