

Simultaneous DTA/TGA

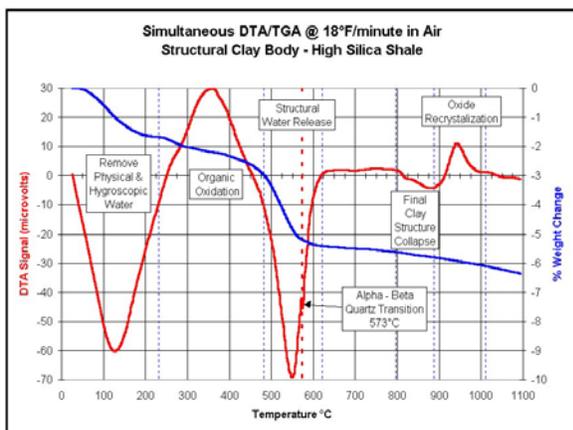
The Orton **Simultaneous DTA/TGA** is a powerful thermoanalytical technique that combines a DTA and a TGA into one instrument that performs both DTA and TGA on the same sample at the same time. This instrument or testing technique is sometimes referred to as Simultaneous Thermal Analysis, or STA, or simply ST. The resulting DTA and TGA curves are simultaneously plotted on a dual Y-axis graph so the DTA's fingerprint and the TGA's weigh loss/gain characteristics are directly compared as the test sample is heated and cooled.

The photo at the right is the Model ST-730 series simultaneous DTA/TGA System which includes the furnace, differential thermocouple, analytical balance, and furnace control console with user-programmable controller. Although not shown, the system includes Windows 98/2000 compatible data acquisition/analysis software and an analog to digital interface card for the user supplied personal computer system. The included software displays the test progress on the monitor, stores the data and enables the user to perform the standard DTA and TGA analyses on the data after the test is completed.

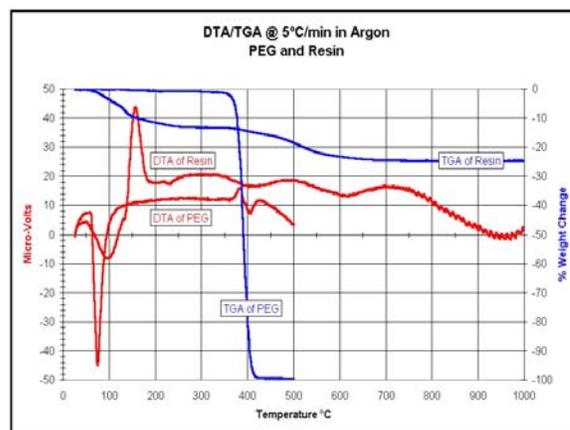


The DTA identifies the temperature regions and the magnitude of critical events during a drying or firing process such as drying, binder burnout, carbon oxidation, sulfur oxidation, structural clay collapse, cristobalite transitions, alpha-beta quartz transitions, carbonate decompositions, recrystallizations, and melting. The TGA measures the weight loss of a material from a simple process such as drying, or from more complex chemical reactions that liberate gasses, such as structural water release, structural decomposition, carbonate decomposition, sulfur oxidation, and fluoride oxidation. The TGA also measures the weight gain of a material from a simple process such as re-hydration, or from more complex surface reactions from reactive gas atmospheres. Sample graphs of enhanced standard outputs are shown below.

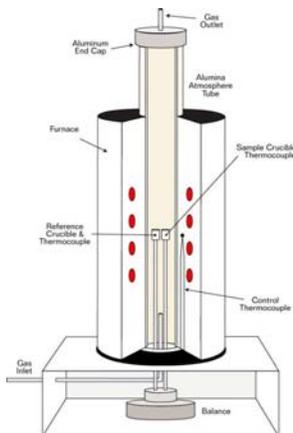
Ceramics - Structural Clay Analysis



Ceramics - Body and Binder Studies



Principle of Operation



The standard Orton Simultaneous DTA/TGA uses a pan balance, in which the sample and reference cups are supported by a pair of vertical thermocouples (differential thermocouple) positioned on the balance load cell (concept sketch to the left). After both cups are placed on top of the differential thermocouple stalks, the furnace is lowered over the cups, the balance is zeroed, and the furnace is heated and cooled according to the programmed thermal cycle. The differential thermocouple output (DTA signal) and balance output (TGA signal) are continuously recorded, displayed on a PC monitor, and stored on the PC for post testing analysis.



Standard Simultaneous DTA/TGA Instruments from Orton

The standard Orton Simultaneous DTA/TGA uses one of two pan balances with different sensitivity ranges, and an appropriate furnace for the desired temperature range.

Model Number Series	ST-730	ST-740
Room Temperature to 1,200°C	ST-732	ST-742
Room Temperature to 1,600°C	ST-736	ST-746
Sample Volume (cubic millimeters)	150	150
Sample Size (grams)*	up to 0.350	up to 0.350
Sample Cup Material	High Alumina	High Alumina
Sample Cup Design	Boersma	Boersma
Differential Thermocouple	Type "S"	Type "S"
DTA Sensitivity (micro-volts)	< 0.0005	< 0.0005
Atmospheres	Air, Argon, Nitrogen	Air, Argon, Nitrogen
Range of Sample Weight Change*	5 to 33%	2 to 20%
Balance Sensitivity (micro-grams)	100	10
Electric Power	120 VAC, 15 amp, 50/60 Hz	120 VAC, 15 amp, 50/60 Hz
Cooling Water to Open Drain	< 1 gallon / minute	< 1 gallon / minute



* Note: assume a material with a green specific gravity of 2.35 g/cc

The Orton Simultaneous DTA/TGA instruments have been specifically designed for ceramics and other materials that require sample sizes larger than DSC's to insure sample homogeneity. A typical simultaneous DTA/TGA heat up rate for ceramic materials is 10°C per minute. Faster or slower rates are possible by simply changing the thermal cycle on the system's PID furnace controller. Most ST tests are performed at a standard heating rate to the maximum temperature, then discontinued. With the Orton systems, the thermal cycle can be extended to include the cooling data. In addition, other programmed cycles that contain multiple ramps and soaks, such as actual production drying or firing schedules, are possible. The Orton Model ST-730/740 series systems are designed for standard ceramic applications. The Model ST-730/740 series systems are equipped with an atmosphere port and simple control flow valve for flowing air, argon, or nitrogen through the testing chamber. The Orton systems are not sealed for vacuums, corrosive atmospheres, or ultra low oxygen content atmospheres. For controlled atmosphere or low weight change testing, ask Orton about High Performance DTA/TGA Systems.

(Descriptions and specifications are subject to change without notice - 10 July 2003)