

Introduction

Productivity is important for modern analytical lab. Pharmaceutical lab may run several hundreds of sample for material screening, quality control etc. Reliable and unattended performance is the key to the high throughput. The latest DSC technology--- HyperDSC® performed on power controlled DSC also increases productivity by heating and cooling at a scanning rate at least one order of magnitude higher than conventional DSC. The experiment time is shortened significant, while at the same time sensitivity is increased because the DSC signal depends on both sample mass and heating rate. Many unique features of power controlled DSC make the fast scanning rate possible. In this poster, these features get reviewed. The features include the small furnace which is much lighter than conventional heat flux DSC furnace. The response of the whole measuring system is quick. The startup transition is short, that means the furnace will get into control shortly after the start of temperature program and begin to collect valid heat flow data even at a heating rate of 750 °C/min. The same thing will be true for the furnace to go from scanning (heating or cooling) to isothermal temperature. The reliable and robust autosampler will make the run 24/7 without interruption.

Small furnace

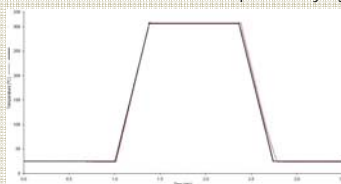
Power controlled double-furnace DSC utilizes two independent, low-mass furnaces compared with the single, bulky furnace of heat flux DSC. The furnace is made of chemically inert platinum alloy which offers excellent chemical resistance. The small furnace enables fast heating and cooling capability and fast response time which contribute to the increased productivity. The weight of the new DSC 8500's furnace is further reduced by 27% compared with the previous Diamond DSC furnace, which increases the heating and cooling rate to 750 °C/min vs. 500 °C/min on Diamond DSC.



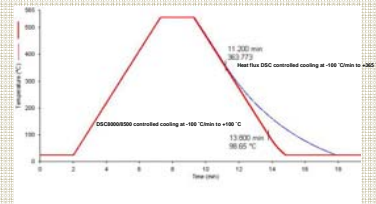
Comparison of furnace size between heat flux DSC and power controlled DSC

Fast Heating and cooling

Compared with Diamond DSC furnace, the new DSC furnace uses a new construction technology and new alloy material. The weight is 27% less than the Diamond DSC furnace and the thermal conductivity is doubled due to the usage of new alloy material. It increases the maximum controlled heating and cooling rate from +500 °C/min to +750 °C/min. It can also reach lower temperature under controlled cooling experiment so that the working temperature range is expanded. It offers very fast cooling time so that the furnace temperature can be brought down quickly after one experiment and the waiting time is reduced. All these features increase the productivity significantly.



Controlled heating and cooling at 750 °C/min on DSC 8500, from room temperature to +300 °C with CLN2 cooling accessory and Helium purge. The black curve is the program temperature and the red curve is the sample temperature. The sample temperature is in control during cooling until +100 °C.



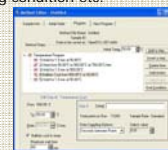
The comparison of controlled cooling between DSC8000/8500 and heat flux DSC. Heating/Cooling at 100 °C/min from room temperature to +550 °C with Intracooler II cooling accessory and Nitrogen purge. The red curve is the sample temperature from DSC8000/8500 and the blue curve is sample temperature from heat flux DSC. The heat flux DSC can only reach +365 °C in control while the DSC 8000/8500 stays in control at 100 °C/min cooling until +100 °C. As a result, the working temperature range during cooling from DSC8000/8500 is much bigger than that from a heat flux DSC.

Ambient Coolant	nitrogen purge	Liquid N2 coolant-helium purge
110 °C/min to 22 °C	110 °C/min to -170 °C	110 °C/min to -170 °C
20 °C/min to 35 °C	50 °C/min to -165 °C	50 °C/min to -165 °C
50 °C/min to 70 °C	100 °C/min to -140 °C	100 °C/min to -140 °C
100 °C/min to 125 °C	200 °C/min to -100 °C	200 °C/min to -100 °C
	300 °C/min to -60 °C	300 °C/min to -60 °C
	400 °C/min to -20 °C	400 °C/min to -20 °C
	500 °C/min to +30 °C	500 °C/min to +30 °C
	750 °C/min to +100 °C	750 °C/min to +100 °C
Ambient Coolant	700 °C to 100 °C	<2minutes
Liquid N2 coolant	100 °C to -100 °C	<0.5 minute

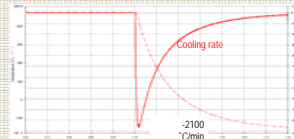
Table of controlled cooling results and cooling time from DSC8500. It shows the lowest temperature the furnace can reach under different controlled cooling rates with two different cooling accessories---chiller and CLN2.

Ballistic cooling mode

Ballistic cooling mode is a new mode from DSC 8500. It can reach the maximum cooling rate. During ballistic cooling, the power to the furnace is turned off completely so that the furnace temperature will drop as fast as possible. As soon as the sample temperature reaches the end program temperature, the power will be brought back and the sample temperature will stay in control again. Depending on the cooling accessory, purge gas and starting temperature, the ballistic cooling step can reach an instant cooling rate as fast as 2100 °C/min. The fast cooling rate will not only increase productivity but also enable applications like improved isothermal crystallization study, better mimicking polymer processing condition etc.



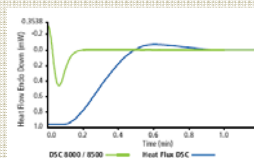
Method editor of DSC 8500 showing ballistic cooling step. Check the ballistic cool box to enable ballistic cooling mode. Note the fast data rate available for fast rate experiment. The maximum data rate is 0.01 second between points or 100 points/second.



Ballistic cooling curve from DSC 8500 with CLN2 cooling accessory and helium purge. The red dashed curve is the sample temperature and the red solid curve is the derivative of sample temperature indicating the cooling rate. The maximum instant cooling rate reaches 2100 °C/min

Fast response time

The small furnace of DSC8000/8500 also means fast response time. It means that the startup transition at the beginning of the experiment is shorter and the heat flow reaches equilibrium much faster than heat flux DSC does. This is very useful for applications like UV curing study where the curing reaction is very exothermic and very fast; isothermal crystallization where some polymeric material will crystallize quickly (< 1 min) and fast scan DSC experiment when hundreds of degree per minute heating rate is used.



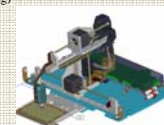
Comparison of response time between DSC 8000/8500 and heat flux DSC. The response time is about 0.2 min from DSC 8000/8500 vs. 1.0 min from heat flux DSC

Brand-new Autosampler

DSC 8000/8500 come with optional brand new autosampler, so you can perform automated analyses smoothly with minimal effort. And with our Pyris Player software, setting up a run on autosampler is simple and quick—and you can run samples during and after business hours to maximize your productivity. Not sure if you need an autosampler today? Our autosamplers are available as upgrade options to meet the growing demands of your lab.

Key Features include:

- Super reliable
- Picks up all PerkinElmer Pans
- Auto-Aligning
 - Touch off detection calculates location of Tray, lids and cups
- Smart design
 - Drop pan prevention
 - Continuous Vacuum detection
- New Micro Titer Plate Tray format (pharma-standard)
 - 96 sample capability (8X12 array on 9mm spacing)
- Multiple tray formats with smart recognition
- User install-able
- Compact design



Summary

The many new features on DSC 8000/8500 including the small furnace which is much lighter than conventional heat flux DSC furnace; the fast response of the whole measuring system; the reliable and robust autosampler together with the player list software which ensure continuous operation smoothly. All these features increase the throughput and productivity for polymer or pharmaceutical companies.