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Discover a NEW LEVEL of DSC Performance

Discover a NEW DESIGN

The Discovery DSC represents the latest innovation from TA Instruments. Building on the Tzero® technology first pioneered in our Q Series™ instruments, the Discovery DSC introduces our innovative Diffusion-Bonded Sensor technology. This technology represents the future of temperature and heat flow measurements. The Discovery DSC provides unmatched precision, accuracy, industry-leading sensitivity and resolution.

The result is a Differential Scanning Calorimeter which improves every aspect of DSC performance…

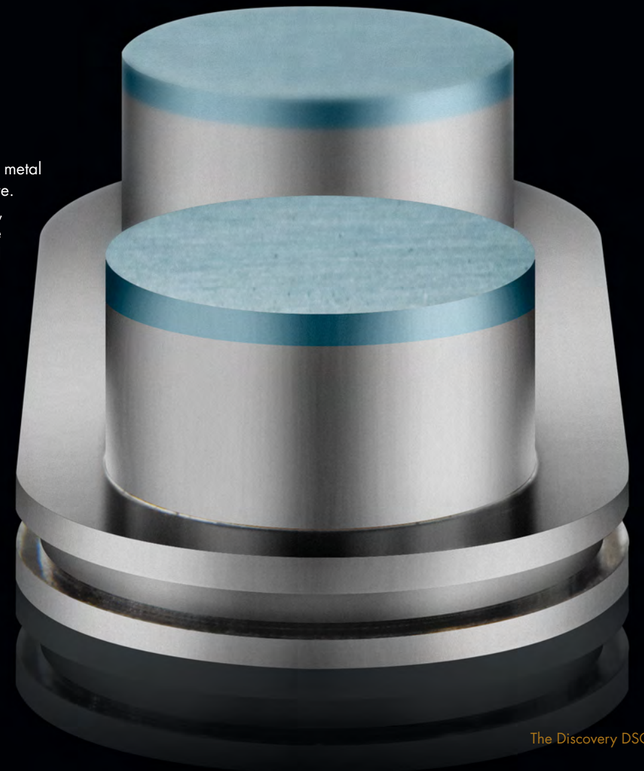
The New Discovery DSC

DISCOVER THE DIFFUSION-BONDED SENSOR; THE FUTURE OF TEMPERATURE AND HEAT FLOW MEASUREMENTS

TECHNOLOGY

Diffusion bonding of metals is accomplished by placing two metal surfaces in contact at an elevated temperature and pressure. Over time, diffusion of the metals occurs at the atomic level, producing an intimate, continuous, high-quality bond. In the Discovery DSC, chromel and constantan are diffusion-bonded to produce **the perfect thermocouple**. In the resultant transducer structure, the diffusion bond is positioned just below the sample surface, **in the perfect position**. The measurement is less sensitive to pan placement effects thereby maximizing repeatability. Unlike alternative designs which employ discreet sensor points, the Diffusion-Bonded Sensor represents a continuous thermosensitive surface, dramatically improving sensitivity of the temperature measurement while maintaining a very short time constant for excellent signal resolution.

*US Patent No. 7,470,057



The Discovery DSC includes multiple innovations designed to increase performance and stability

Uniblock Silver Furnace

The Uniblock furnace is precisely machined from a single block of silver, providing temperature uniformity and ensuring thermal homogeneity. The result is reduced thermal gradients, increased ruggedness and improved measurement precision.

Diffusion-Bonded Sensor

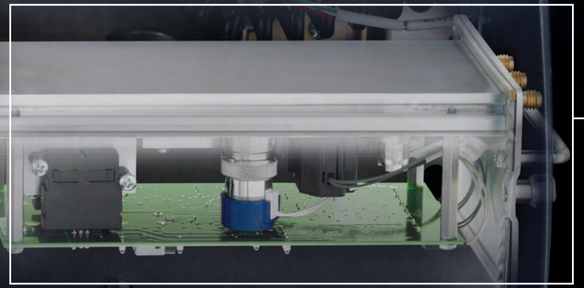
The heart of the Discovery DSC technology is the Diffusion-Bonded Sensor. To ensure highly-repeatable and stable measurements, the transducer is precision-mounted on a fixed pedestal. Unlike competitive designs where sensors are allowed to move, this pedestal mounting results in a stable configuration with a well-defined heat-flow path unaffected by thermal gradients. The result is unmatched precision and repeatability of the heat flow and temperature measurements.

Temperature Controlled Electronics

The Discovery DSC cell processes the measured signals through an insulated conduit to state-of-the-art temperature-controlled electronics, eliminating the adverse influence of temperature variation on the electronics which is commonly found in competitive technology.

Gas-Delivery Module

Our innovative Gas-Delivery Module is standard on the Discovery DSC. The manifold design eliminates tubing and hardware connections which are prone to leaks, ensuring a highly consistent, repeatable inert atmosphere. For experiments which require dynamic or reactive atmospheres, software-controlled gas switching is also supported.



Reliable Automation

TA's proprietary autosampler technology* is a standard feature on every Discovery DSC. Field proven in thousands of laboratories, the reliable and easy-to-use autosampler enables customers to generate superior DSC data around the clock. Powerful new TRIOS software makes it easier than ever for users to manage the sample queue. The re-designed Discovery DSC auto-lid provides consistent and repeatable cell closure, providing effective thermal isolation for the sensor, and further improving measurement repeatability.

*U.S. Patent No. 6,644,136; 6,652,015; 6,760,679; 6,823,278

DISCOVER RELIABLE AUTOMATION AND ENHANCED PRODUCTIVITY

DISCOVER A REVOLUTIONARY NEW USER INTERFACE

User Interface

The Discovery DSC redefines the interaction with the instrument. The large, intuitive display and interactive menus guide the user to perform calibrations, control autosampler routines, and load or unload samples. Simple experiments can be programmed and initiated through the new QuickRun menu, and experimental progress can be monitored with the customizable real-time signal display.

Performance

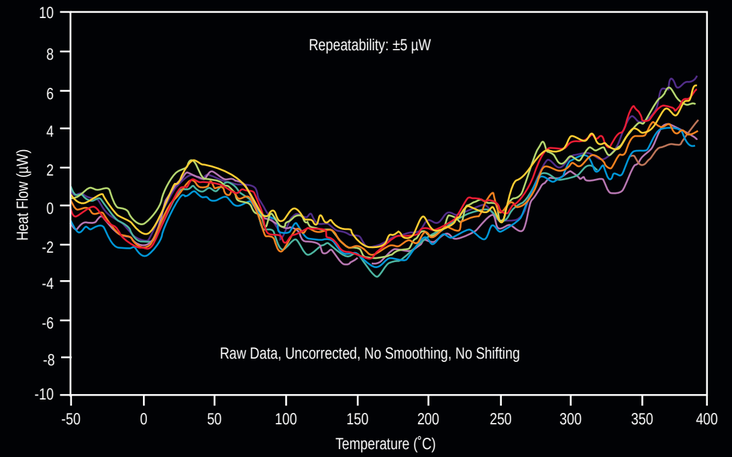
TA Instruments invented Tzero® Technology, a fundamentally better way to measure heat flow. Tzero Technology provides the flattest baselines, and highest combined sensitivity and resolution of any DSC available. The Discovery DSC builds on this innovation, and through our latest advancements provides unmatched precision, repeatability and accuracy of heat flow and temperature measurements, while maintaining our industry-leading sensitivity and resolution. The result is a DSC which improves every aspect of DSC performance, and **delivers meaningful and measurable benefits** to the user.

Baseline

The foundation of any analytical measurement is the baseline. A well-designed instrument should contribute very little to the sample measurement, and the baseline is the fundamental measurement of this contribution. For a DSC baseline, the right answer is "zero", as any errors in the baseline will propagate directly to the sample data.

The Discovery DSC technology produces a baseline which is perfectly flat, extremely reproducible, and quantitatively correct. This allows for an unmatched degree of accuracy for subsequent enthalpy and heat capacity measurements on your samples.

The figure below demonstrate the performance of the Discovery DSC baseline, in linearity, repeatability and accuracy; critical parameters for quantitative DSC results.

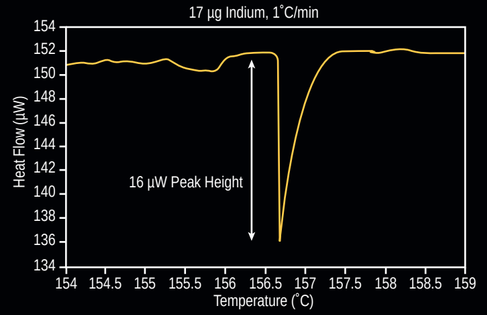


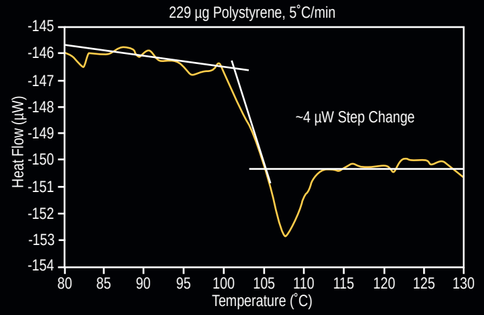
Applications

Sensitivity & Resolution

There are countless ways to measure the sensitivity of a DSC, and test methods are often exploited to promote performance under a specific set of conditions. However, experienced thermal analysts know that the best DSC provides sensitivity under all experimental conditions. The Discovery DSC delivers the highest sensitivity for a diverse range of heat flow transitions, across a wide range of experimental scanning rates. This is accomplished through the combination of transducer innovations and our patented Tzero® technology which flattens the baseline, maximizes the signal response and minimizes short-term noise. The result is the highest level of sensitivity for your materials, under any experimental condition.

The figures below demonstrate the high level of sensitivity inherent in the Discovery DSC, for both subtle peaks (17 µg sample of indium) and step change transitions such as the 4 µW Tg of a polystyrene sample



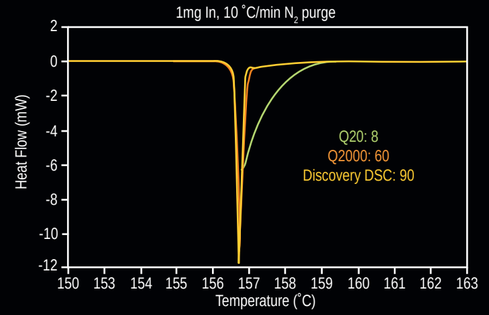


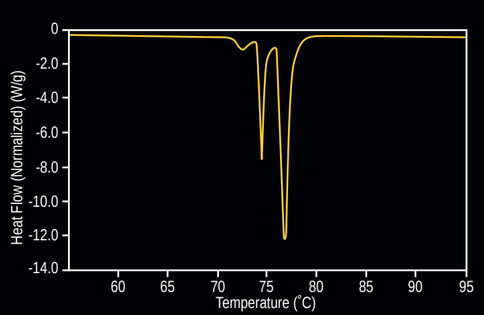
Resolution

Historically, it was challenging to simultaneously optimize both the sensitivity and resolution of a DSC signal. The faster rates required for higher sensitivity degraded the resolution of the measurement. This limitation is evident in competitive technology, where users are required to choose between a sensor which optimizes sensitivity versus one which provides higher resolution.

The Discovery DSC is designed to simultaneously optimize both sensitivity and resolution. The Diffusion-Bonded transducer optimizes signal quality and sensitivity while minimizing thermal resistance, reducing the time constant of the measurement. The result is the highest combined sensitivity and resolution available in a DSC today.

The figure on the left below shows the resolution performance of the Discovery DSC, when quantified using the industry-standard Indium Response Ratio (H/W). The figure on the right demonstrates a practical application of this high resolution, the analysis of an organic compound at 5°C/min. This sample undergoes solid-state "lambda" transition followed closely by a melt. The superior performance of the Discovery DSC allows for these two transitions to be easily resolved.





Discover EFFORTLESS REPEATABILITY in heat flow measurements

Applications

Direct Measurement of Heat Capacity

Many applications require not only the measurement of accurate heat flow, but also quantitative heat capacity. Heat capacity is the fundamental intrinsic property of a material which gives rise to heat exchange, and is an incredibly sensitive indicator of structural morphology in a sample. Historically, heat capacity measurements were performed using a three-run or step-iso method. In addition to the sample measurement, additional runs were necessary to account for baseline artifacts and non-linearity. Whereas these methods can provide accurate heat capacity, they are laborious and time-consuming.

The Discovery DSC is free from the baseline artifacts which affect competitive instruments. This quantitatively-accurate baseline provides for the direct measurement of heat capacity in a single run, without the complications and uncertainty of extraneous events or time-consuming requirements of alternative techniques. This allows for additional information to be gathered about your sample, in an accurate, repeatable and easy-to-use manner. Figure A illustrates the high level of precision and accuracy in direct Cp measurements on the Discovery DSC.

Precision and Accuracy

An instrument's performance is only as good as its repeatability, and scientists demand results with a high level of precision and accuracy. TA Instruments recognizes this need for precise data and have engineered into the Discovery DSC patented and proprietary technology which provides effortless measurement repeatability. The combination of the technical innovations results in a level of measurement precision previously unattainable.

Figures B-D demonstrate this level of measurement repeatability on both standard materials as well as real-life samples. In all cases, the sample was removed and replaced in between each run.

Figure A

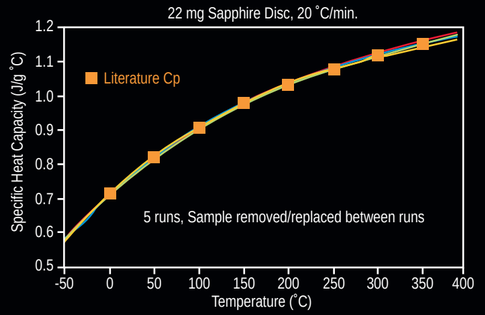


Figure B

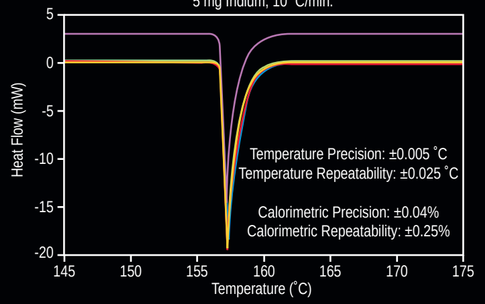


Figure C

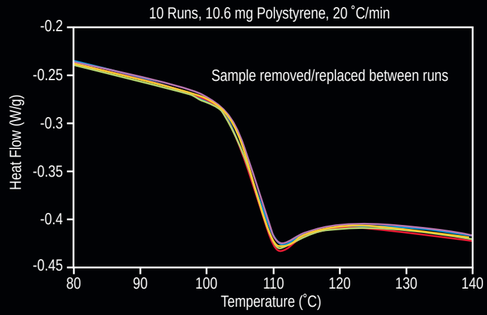
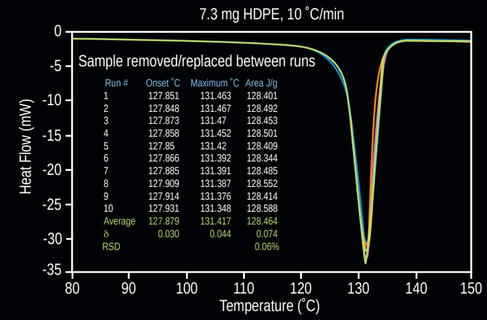


Figure D



Technical Specifications

Specification	Value
Temperature Range	-180 – 725 °C
Temperature Accuracy	±0.025 °C
Temperature Precision	±0.005 °C
Enthalpy Precision	±0.04%
Heat Flow Noise (rms)	≤0.08 µW
Baseline Linearity (-50° – 400 °C)	≤5 µW
Baseline Accuracy (-50° – 400 °C)	±20 µW
Baseline Repeatability (-50° – 400 °C)	±5 µW
Measurement Time Constant	≤0.8s
Indium Response Ratio	≥90
Direct Cp Accuracy (-50° – 400 °C)	≤3%
Direct Cp Precision (-50° – 400 °C)	≤1%
Direct Cp Repeatability (-50° – 400 °C)	≤1%

Instrument Features

Technologies	
Color Touchscreen User Interface	Included
Advanced Tzero® Technology	Included
Advanced Modulated DSC®	Included
Direct Cp Measurement	Included
User Replaceable Cell	Included
50-Position Autosampler	Included
Autolid	Included
Dual Input Gas Delivery Module	Included
Full Range of Cooling Accessories (RCS90, RCS40, LN2P, FACS, QCA)	Available
Photocalorimeter	Available
Optical Accessory Kit (Raman, NIR)	Available

Compatible with Q Series™ RCS Systems (RCS90 & RCS40)
Compatible with Tzero® DSC Sample Encapsulation Press


DISCOVERY
series

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