

**C-THERM TCI™**  
Thermal Conductivity Analyzer

**Fast, Accurate Testing**

0 to 100 W/m•K in 5 seconds

**Wide Temperature Range**

-50° to 200°C

**Easy-to-Use**

No calibration required

**No Sample Preparation**

Unlimited sample sizes

**Non-Destructive**

Leaves sample intact

**Versatile**

Tests solids, liquids,  
powders and pastes

**Highly Flexible**

Designed for lab, QC, and  
at-line testing

# Versatile.

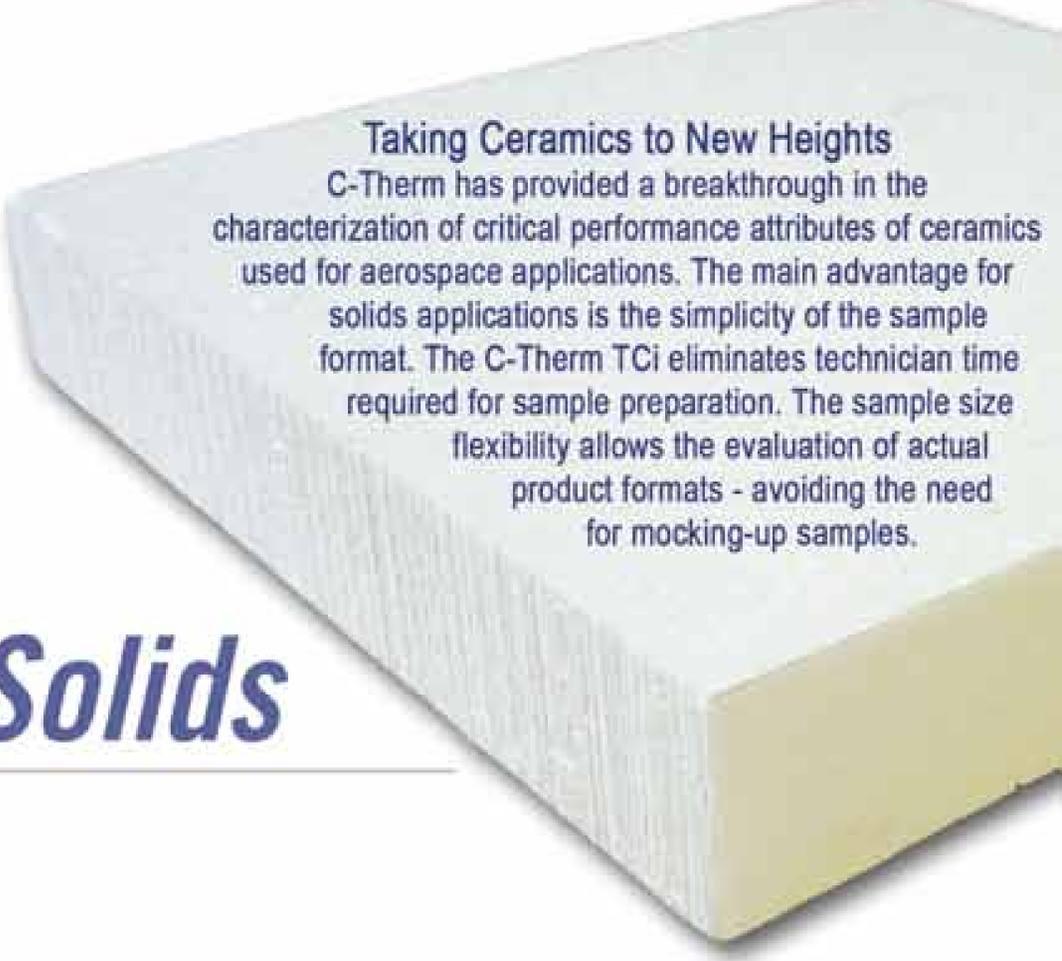
The C-Therm TCi is truly a "one size fits all" thermal conductivity tool. No other instrument can test solids, liquids, powders, and pastes. Within a material type, the technology has the attributes necessary as a lab tool to accelerate your research & development efforts or improve your quality control. As an added bonus, the technology can be migrated to the shop floor to gain insights into your production processes.

## Fluids That Take The Heat Off

The C-Therm TCi is helping manufacturers improve the heat transfer properties of advanced nano-filled liquids. For engineered liquids, the wide range of operating temperatures make the C-Therm TCi an attractive solution. The low amount of heat introduced during testing minimizes the convective errors typical in liquid testing. Lab users can opt to test through a bag, while process users can measure directly in contact with the fluid in a vessel.

## Keeping the Hottest Electronics Cool

The faster and smaller microprocessors become, the more heat they generate. C-Therm is providing vital insights into the development of all materials that contribute to the overall thermal budget, including thermal interface pastes. The C-Therm TCi allows testing with different amounts of heat penetration. This feature results in a variable scale of scrutiny to probe the material to ensure the homogeneous distribution of vital filler components.



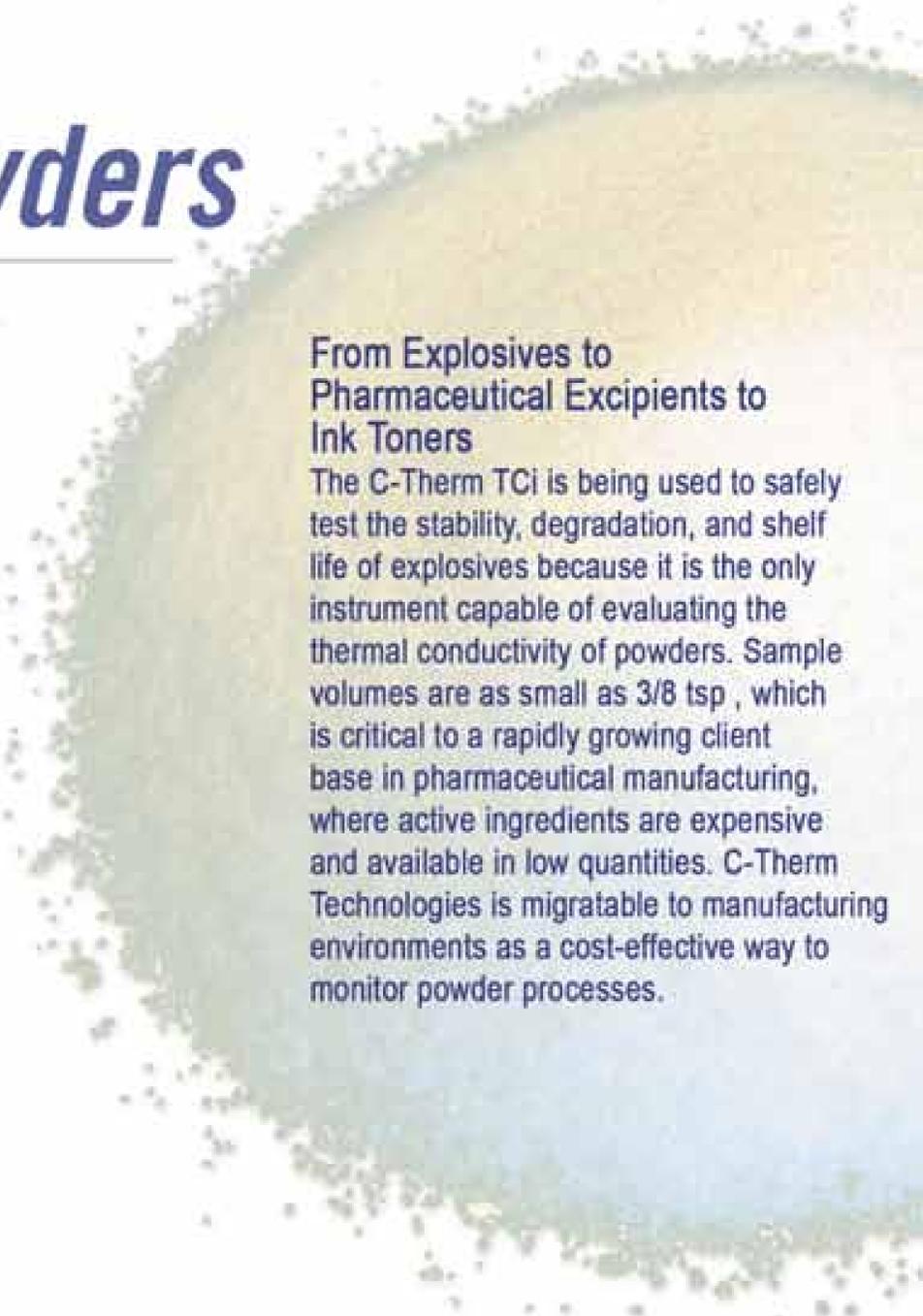
**Taking Ceramics to New Heights**  
C-Therm has provided a breakthrough in the characterization of critical performance attributes of ceramics used for aerospace applications. The main advantage for solids applications is the simplicity of the sample format. The C-Therm TCi eliminates technician time required for sample preparation. The sample size flexibility allows the evaluation of actual product formats - avoiding the need for mocking-up samples.

## Solids

## Liquids



## Powders



### From Explosives to Pharmaceutical Excipients to Ink Toners

The C-Therm TCi is being used to safely test the stability, degradation, and shelf life of explosives because it is the only instrument capable of evaluating the thermal conductivity of powders. Sample volumes are as small as 3/8 tsp, which is critical to a rapidly growing client base in pharmaceutical manufacturing, where active ingredients are expensive and available in low quantities. C-Therm Technologies is migratable to manufacturing environments as a cost-effective way to monitor powder processes.

## Pastes

# Simple.

The third generation of C-Therm technology expands the capabilities of this rapid, non-destructive thermal conductivity and effusivity testing instrument to a whole new level. Designed to provide simple, highly accurate thermal characterization for lab, quality control and production environments, the C-Therm TCi Thermal Property Analyzer requires no calibration or sample preparation. The system has broad testing capabilities (0.0 to 100 W/m-K) across a wide range of temperatures (-50° to 200°C).

The TCi can be equipped with one or two sensors for increased capacity, and provides accurate thermal analysis of solids, liquids, powders and pastes in less time than any other instrument – only 5 seconds. And because the procedure is non-destructive, samples remain intact, undisturbed and reusable after testing.



## Principles of Operation

The C-Therm TCi is based on the modified transient plane source technique. It uses a one-sided, interfacial, heat reflectance sensor that applies a momentary, constant heat source to the sample.

Both thermal conductivity and effusivity are measured directly and rapidly, providing a detailed overview of the thermal characteristics of the sample material.

$$\text{Effusivity} = \sqrt{k\rho c_p}$$

Where:

$k$  = thermal conductivity (W/m·K)

$\rho$  = density (kg/m<sup>3</sup>)

$c_p$  = heat capacity (J/kg·K)

## How It Works

Sample material can be a solid, liquid, paste or powder.

A known current is applied to the sensor's heating element providing a small amount of heat.

The heat provided results in a rise in temperature at the interface between the sensor and the sample - typically less than 2° C.

This temperature rise at the interface induces a change in the voltage drop of the sensor element.

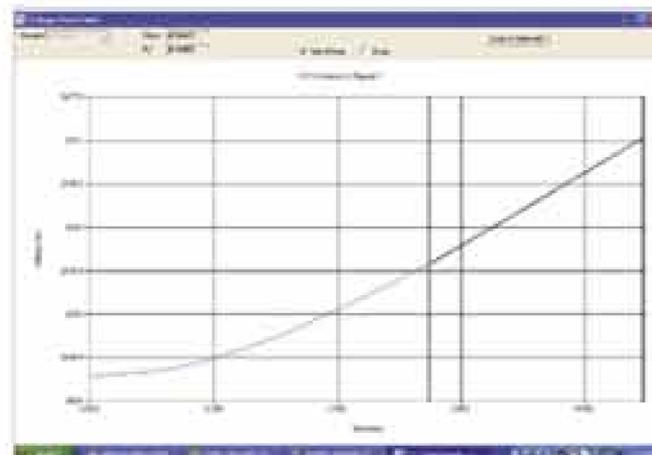
The rate of increase in the sensor voltage is used to determine the thermo-physical properties of the sample material.



The thermo-physical properties of the sample material are inversely proportional to the rate of increase in the sensor voltage.

The more thermally insulative the material is - the steeper the voltage rise.

Results are displayed on the system's laptop computer in real-time.



# Fast.

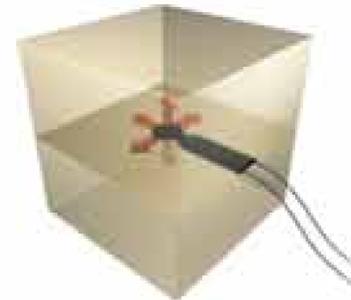


**Fast Test Preparation – No Calibration or Sample Prep Required:** A key advantage of the C-Therm TCi is the fact that it does not require time consuming calibration or sample preparation. The instrument comes fully calibrated from the factory. The auto-test function even allows hands-free testing at pre-determined intervals.

**Rapid Testing – 0 to 100 W/m-K in 5 Seconds:** The C-Therm TCi helps you accelerate your research or quality control processes. Test times range from only 0.8 to 5 seconds – start to finish. Capable of highly accurate, repeatable testing, it is a versatile addition to your material characterization tools.

**Add a Second Sensor for Increased Testing Capacity:** The C-Therm TCi can be equipped with as second sensor, allowing you to double your throughput. With its rapid testing capabilities, and two sensors, the C-Therm TCi provides real-time thermal characterization for a wide range of materials.

## Superior to Other Test Methods:



### Speed & Flexibility

Sample Preparation	None Required	Extensive	Some	Extensive
Testing Time	Seconds	Hours	Minutes	Seconds*
Training Time	Minimal	Moderate	Significant	Extensive
Non-Destructive	Yes	No	No	No
Integrated, Downloadable Test Results Database	Yes	No	No	No

### Range

k-Range (W/m·K)	0 – 100	0 – 2	0 – 100 (100 – 500 requires $C_p$ )	0 – 500
Temperature Range (°F) (°C)	-58° to 392°F -50° to 200°C	-4° to 392°F -20° to 200°C	-148° to 2552°F -100° to 1400°C	-148° to 3627°F -100° to 2000°C

### Sample Configuration

Minimum	0.67" diameter (17mm)	6" x 6" (150 x 150mm)	Two Identical Samples 1" x 1" (25 x 25mm)	0.5" diameter (12.4mm) 0.004" thick (1mm)
Maximum	Unlimited	24" x 24" (600 x 600mm)	Two Identical Samples Unlimited	0.5" diameter (12.4mm) 0.004" thick (1mm)
Material Testing Capabilities	Solids, Liquids, Powders, Pastes	Solids	Solids, Liquids	Solids
Pricing	\$	\$ †	\$ \$	\$ \$ †

† Based on publicly available information and feedback from users.

\* Calculation of thermal conductivity from Laser Flash Diffusivity Measurement requires heat capacity ( $C_p$ ) from Differential Scanning Calorimeter (DSC).

# User-Friendly.

## Testing Made Simple – Start to Finish

C-Therm has made accurate thermal characterization of materials both fast and simple. The C-Therm TCi eliminates the need for special training, pain-staking calibration, or sample preparation. The system includes a laptop with C-Therm's intuitive, Windows®-based software interface and a full relational database with importing and exporting capabilities. Downloading your results to Excel® is a snap.



The C-Therm TCi features multiple graphical and tabular display options, and provides direct, indirect\* (calculated), and user input\*\* capabilities for a number of thermal testing properties, including:

- Thermal Effusivity
- Thermal Conductivity
- Thermal Diffusivity\*
- Heat Capacity\*
- Density\*\*

## Modular System to Meet Your Needs

The C-Therm TCi can be configured to meet your specific requirements, based on the materials you are testing. Modules for solid, liquid, powder and paste testing are available with the base unit for maximum flexibility in allowing users to scale their investment specifically to their testing requirements.

## What Our Customers Are Saying

*"The main benefit of the TCi to our testing lab is its ease of use and short test times. It allows us to get accurate results as quickly as possible and with excellent repeatability. Our test times are only a fraction of what they are using steady state methods. Equally important, the service level from the staff at Mathis (C-Therm Technologies) has exceeded our expectations."*

- Dr. Ernest Wolff, CEO, PMIC Lab (Sector: Contract Lab)

*"The technology has allowed us to provide accurate quality assurance for our products that wasn't previously attainable by any other methods. The instrumentation has been a rapid and consistent means for our company to ensure that every product leaving our facility meets our rigid specifications. The TCi technology has given us a competitive advantage. In fact, we've been awarded contracts partly due to the superiority of the TCi instrumentation over every other means of quality testing."*

- Robert Mendenhall, COO, American Aeroel Corporation (Sector: Vacuum Insulation)

*"The outstanding technical support and fundamental understanding of the mathematics and engineering complexities of heat transfer issues has greatly impressed me. I am very pleased with the financial and scientific value of the TCi technology."*

- Keith Kociba, Research Chemist, Lubrizol, Cleveland, OH (Sector: Petroleum)

# Proven.

For over a decade, C-Therm innovative sensor technology has improved the way many of the world's most prominent manufacturers, research facilities, and academic institutions test and measure thermal properties of solids, liquids, powders and pastes. The technology behind the C-Therm TCi represents a paradigm shift in thermal conductivity measurement and was awarded the R&D 100 Award. This coveted international award is given to the top 100 innovations worldwide, and puts Mathis in the distinguished company of other winners, including the ATM, Polaroid film, and anti-lock brakes.

Since its launch, C-Therm's unique technology has evolved to new levels of accuracy, speed, and flexibility. Today, it is being used around the globe for R&D, quality control, and on-line production monitoring to ensure specifications compliance in a wide range of industries.



## Companies and Organizations using C-Therm Technology:

- IBM
- Whirlpool
- Pioneer
- General Electric
- Kodak
- Avery
- 3M
- Philip Morris
- Astra Zeneca
- US Navy
- Patheon
- Wyeth
- Corning
- Engelhard
- Abilestik
- Stowe Woodward
- Dow Corning
- Exxon Mobil
- Hewlett Packard
- NRC

C-Therm TCi Specifications	
Thermal Conductivity Range	0 to 100 W/m-K
Test Time	0.8 to 5 seconds
Minimum Sample Testing Size	0.67" (17mm) diameter
Maximum Sample Testing Size	Unlimited
Minimum Thickness	Nominally 0.02" (0.5mm), dependent on the thermal conductivity of the material
Maximum Thickness	Unlimited
Temperature Range	-58° to 392°F (-50° to 200°C)
Precision	Better than 1%
Accuracy	Better than 5%
Extra Hook-Ups Required	None
Software	Intuitive Windows®-based software interface Easy export to Microsoft Excel® Additional functionality offers indirect, user-input capabilities for a number of other thermo-physical properties including: <ul style="list-style-type: none"> <li>• Thermal Diffusivity</li> <li>• Heat Capacity</li> <li>• Density</li> </ul>
Input Power	110-230 VAC 50-60 Hz
Certifications	FCC, CE, CSA

For more information about the C-Therm TCi Thermal Conductivity Analyzer, please contact:

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