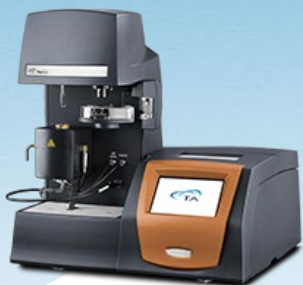


# *Leading the Charge:*

Analytical Solutions for Battery  
Material Characterization



## NAATBatt 2023 Meeting Member Update Presentations



Thermo-  
gravimetric  
Analyzer  
(TGA)



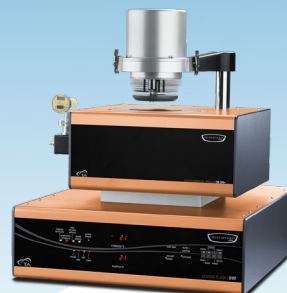
Differential  
Scanning  
Calorimeter  
(DSC)



Simultaneous  
Thermal  
Analyzer (SDT)



Rheometer



Thermal  
Conductivity  
Diffusivity



Micro-  
calorimeter  
(TAM)



Dynamic  
Mechanical  
Analyzer (DMA)



Thermo-  
mechanical  
Analyzer (TMA)

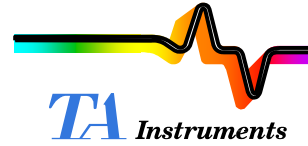
# Our History of Innovation

*Our Foundation*



**1960s**

DuPont roots



**1990**

Spun-off to become  
employee-owned

**Waters™**



**1996**

Acquired by Waters Corporation  
as wholly-owned subsidiary

*...plus,  
strategic  
inorganic  
growth...*



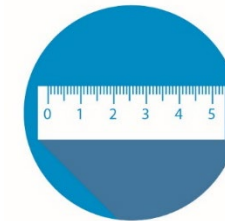
*...to enable best-in-  
class measurement  
of material properties*



Temperature



Weight



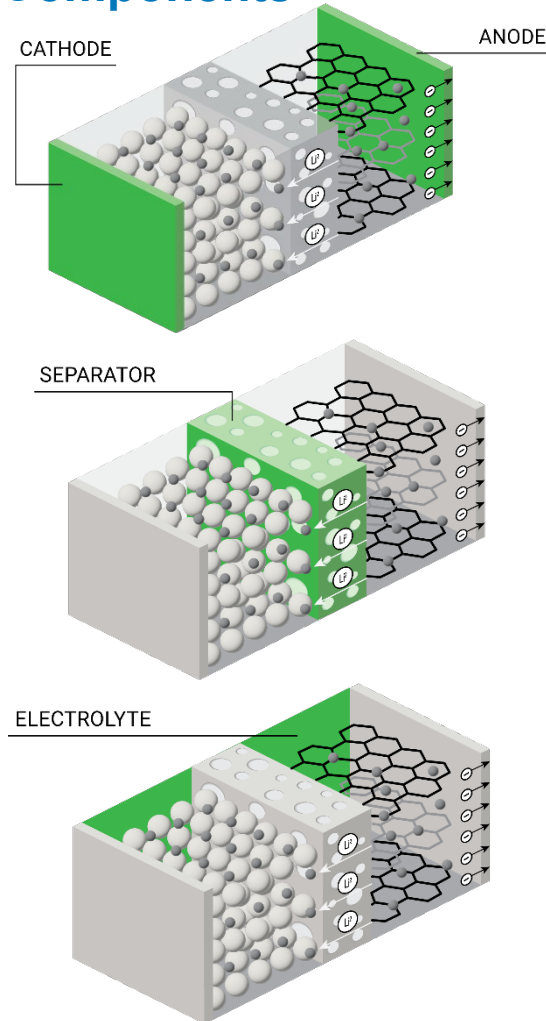
Length



Force

# Material Properties Provide Key Insights to Develop Better Performing, Safer and Cost-effective batteries

## Components



Will this slurry formulation coat correctly?

How uniform is this electrode's composition?

What is the thermal stability of the electrode components?

What is the dimensional stability of this polymer separator?

How does temperature affect the separator's mechanical properties?

At what temperature does the electrolyte undergo phase transition and thermal breakdown?

## Cell



What is the heat flow during charge/discharge?

How significant are the parasitic reactions?

## Battery Pack Materials

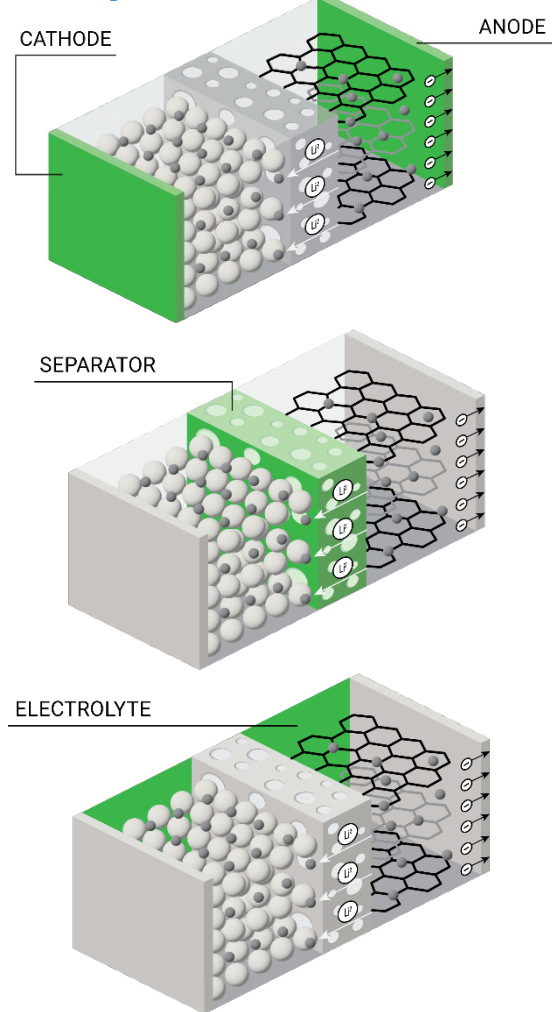


How much heat is removed from the thermal phase change materials?

What is the thermal conductivity of the pack materials?

# Our Analytical Solutions Provide Key Insights to Better Performing, Safer and Cost-effective batteries

## Components



## Cell



TAM

## Battery Pack Materials



DSC



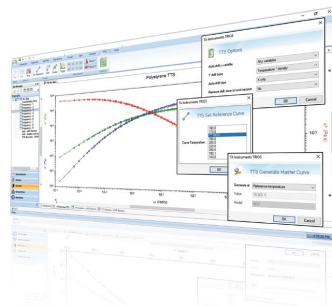
Laser Flash



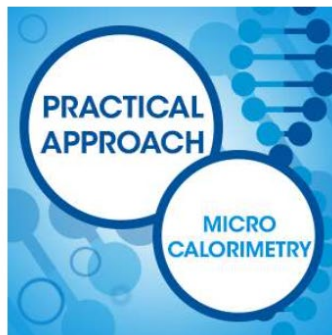
# Ensuring Success with Global Services & Software Support

- Instrumentation with intuitive user interface
  - Program experiments
  - Process experiments
  - View data
  - Analyze data
  - Create report
- Automated calibration routines
- Control charts to detect data trends
- Develop your own models and variables
- Access free, on-demand practical series training:

**TRIOS**



- Over 10,000 installations performed
- Lifetime Support Plan (LSP)
  - Optimized Instrument Performance
  - Well-trained users
  - Maximize uptime
  - Protection from unexpected repair costs
  - Easily budgeted operating expenses
  - Reduced cost of ownership
  - Available for new instruments



# Applications Resources to Support Battery Development

## Application Notes

### An Overview of Isothermal Microcalorimetry in Battery R&D and QA

Keywords: Micro

### The Impact of Electrolyte Additives in Lithium-ion Batteries Determined Using Isothermal Microcalorimetry

Keywords: Isothermal calorimetry, TAM, heat flow, lithium-ion batteries, electrolyte additives, parasitic heat

MCAPN-2014-3a

### Investigations into Dry Cell Battery Discharge Rates Using TAM Air

Keywords: Dry Cell

Lowest Resistance

### An Overview of Isothermal Microcalorimetry in Battery R&D and QA

Keywords: Microcalorimetry, electrochemical, heat, battery, Li-ion, primary, secondary, self-discharge,

MC158

## Webinars



Unlock a New Dimension in your Battery Research Through Isothermal Microcalorimetry



Applications for Isothermal Heatflow Calorimetry – Lithium Ion Battery Chemistry



Enhanced Understanding of Lithium ion Battery Chemistry Through Isothermal Calorimetry



Improving Li-ion Battery Technology through Advanced Material Analysis

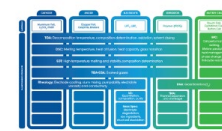
## Additional Resources



### BROCHURE

Analytical Solutions for Lithium-ion Battery Material Characterization

[Download](#)



### INFOGRAPHIC

Lithium-Ion Battery Infographic

[Download](#)



### CASE STUDY

Electrolyte Researchers Work to Creatively Solve Energy-Related Challenges

[Read More](#)



### POSTER

New Insights using Isothermal Calorimetry and High Precision Cycling

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Or visit: <https://www.tainstruments.com/applications/battery-material-testing/>