

Leading the Charge:

Analytical Solutions for Battery
Material Characterization

Waters™ | TA
Instruments

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)

NAATBatt 2023

Our History of Innovation

Our Foundation



1960s

DuPont roots



Waters™



1996

Acquired by Waters Corporation
as wholly-owned subsidiary

...plus,
strategic
inorganic
growth...



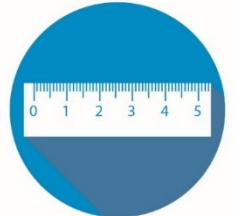
...to enable best-in-class measurement of material properties



Temperature



Weight



Length



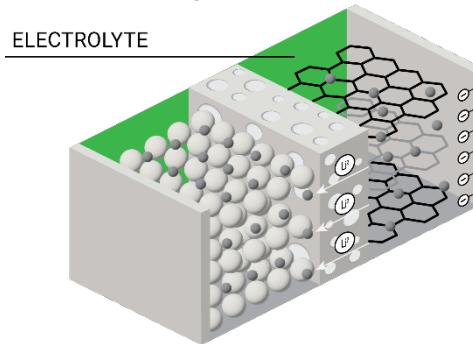
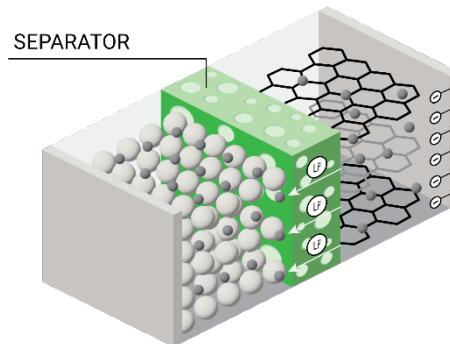
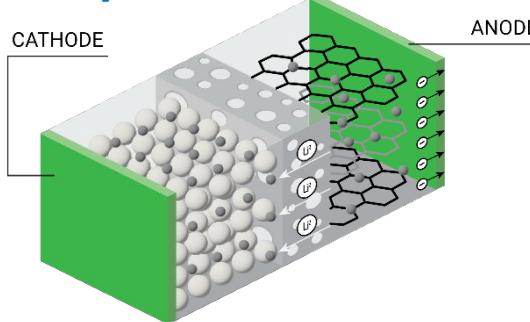
Force

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

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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



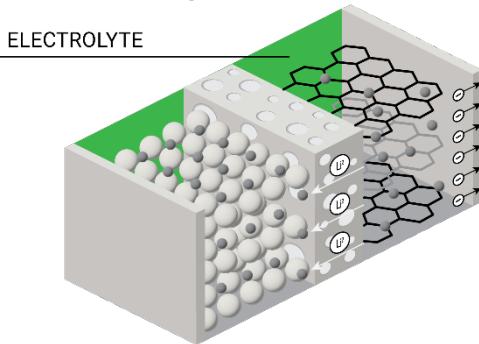
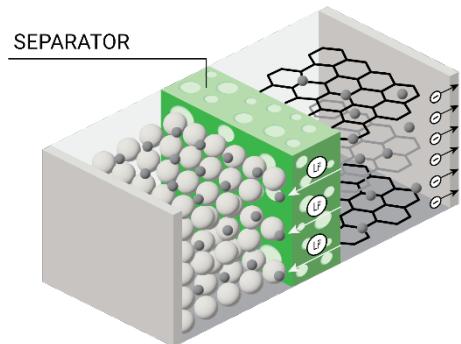
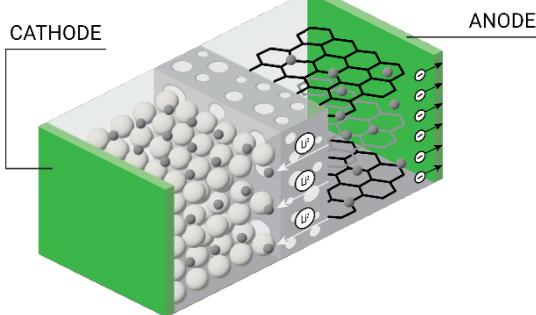
How much heat is removed from the thermal phase change materials?

What is the thermal conductivity of the pack materials?

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

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Components



DSC

Cell



TAM



Battery Pack
Materials



DSC

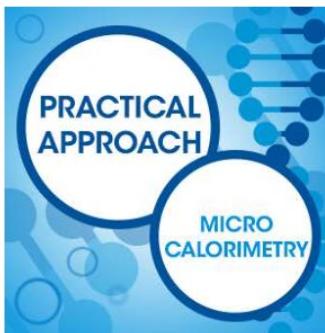
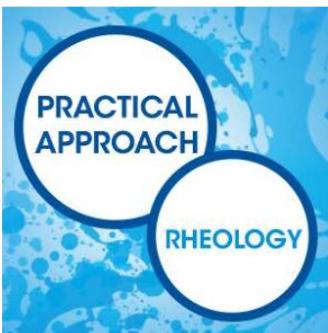
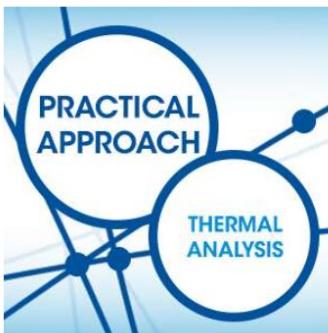


Laser Flash

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:



- 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: Microcalorimetry, heat flow, battery, R&D, QA
Presented by: Malin Suurkuusk, TA Instruments

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 Cells, Low Current, Lowest Resistance
MC158

An Overview of Isothermal Microcalorimetry in Battery R&D and QA
Keywords: Microcalorimetry, electrochemical, heat, battery, Li-ion, primary, secondary, self-discharge, thermal analysis
MC158

Scan for More Information



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

Webinars

Unlock a New Dimension in your Battery Research Through Isothermal Microcalorimetry
Presented by: Malin Suurkuusk, TA Instruments

TAWEBINARS

Applications for Isothermal Heatflow Calorimetry – Lithium Ion Battery Chemistry

Enhanced Understanding of Lithium ion Battery Chemistry Through Isothermal Calorimetry

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OXFORD INSTRUMENTS

Improving Li-ion Battery Technology through Advanced Material Analysis

Additional Resources

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POSTER
New Insights using Isothermal Calorimetry and High Precision Cycling
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