Lithium Batteries and Heat

Battery calorimetry determines the...

Effect of heat on batteries

Heat produced by batteries

Outline information illustrating calorimetry application in areas of...

Battery development
Battery safety
Battery lifecycle and efficiency
Battery performance

...from THT, the world leading suppliers of isothermal and adiabatic calorimeters to those working in the area of lithium batteries

AUTOMOTIVE • POWER TOOLS • AEROSPACE • MILITARY • CONSUMER

thermal hazard technology

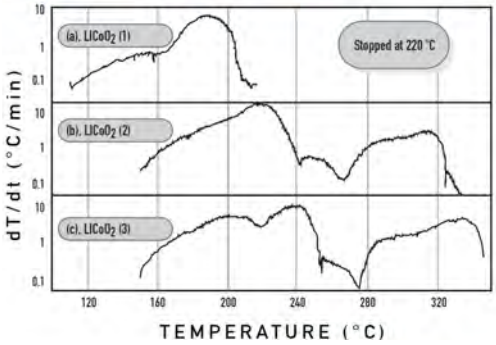
BATTERY STABILITY SAFETY EFFICIENCY LIFECYCLE

Lithium Batteries and Heat:

APPLICATIONS

Battery Development

Effect of Increasing Component Particle Size

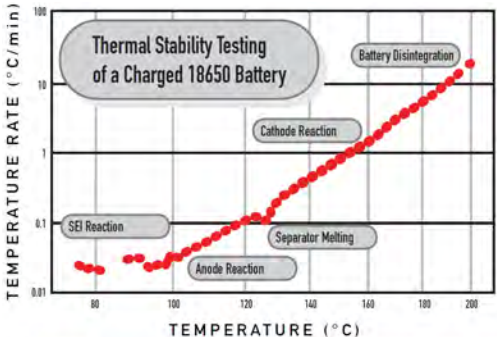


Anode, cathode, electrolyte materials, 2 or 3 component mixtures, lithiated carbon, delithiated oxide; particle size and shape variations. ARC tests have been reported from many groups showing data aiding safer and improved battery chemistry. Data can be complex, work is often carried out by academic groups.

Request: Battery Components Applications Note

Battery Stability

Thermal Stability of an 18650 Battery

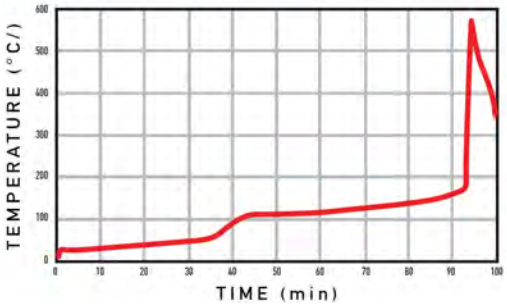


The effect of heat on batteries, onset (stability), speed and amount of heat release (safety). Variation with SoC and age of battery. Batteries of size from coin cell to EV or aerospace modules. Quantify the heat and pressure release, the possibility of battery disintegration or explosion.

Request: Battery Stability & Safety Applications Note

Battery Abuse

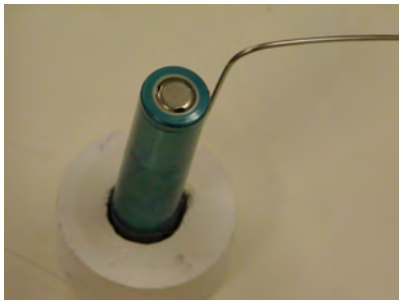
External Short Circuit Test



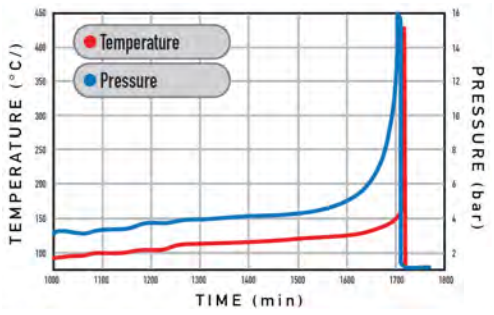
External short circuit, over-voltage charging and discharging; nail penetration, crush. The ability to connect the battery to an external device to monitor voltage, to short, to supply current, to charge/discharge, to cycle... allows abuse testing to be carried out. Monitor temperature during the test, to determine if (e.g.) short circuit leads to a temperature rise large enough to cause disintegration.

Request: Battery Abuse Testing Applications Note

Pressure Measurement



Pressure Determination & Off-Gas Collection



Measure internal pressure with battery connected to a fine tube leading to the pressure transducer. Determine pressure variation in use or during a temperature excursion. Measure external pressure, the pressure rise during gas release and collect gas for analysis.

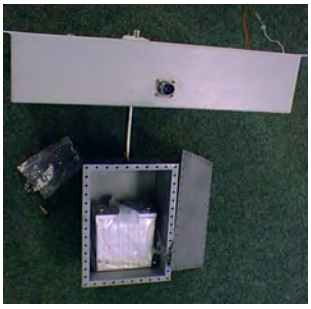
Request: Pressure Determination & Off-Gas Collection Applications Note

www.thermalhazardtechnology.com

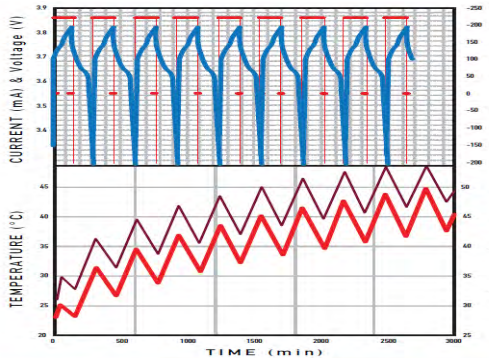
Applications

APPLICATIONS

Battery in Use (Lifecycle & Efficiency)



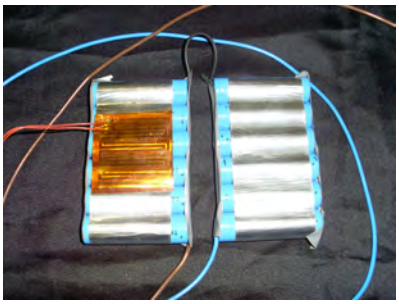
Thermal Effect of Repeated Charge/Discharge Cycles



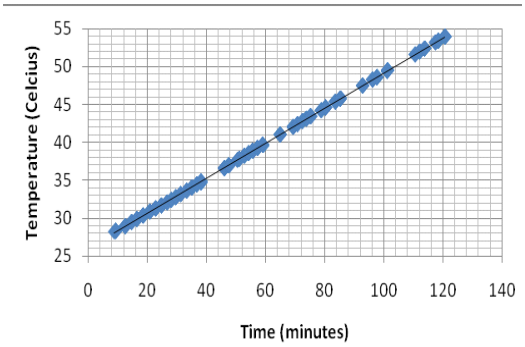
Using a single channel cycler implement repeated CC, CV cycles to quantify the heat release in charge and discharge. Determine variation of heat release over voltage range and with batteries of various age. Compare electrical energy input to the variation of heat release to quantify efficiency and effect of ageing. The heat release variation gives insight into lifecycle.

Request: Heat Effects & Lifecycle – Efficiency Determination Applications Note

Specific Heat Capacity Determination



Heat Capacity of a Small Module

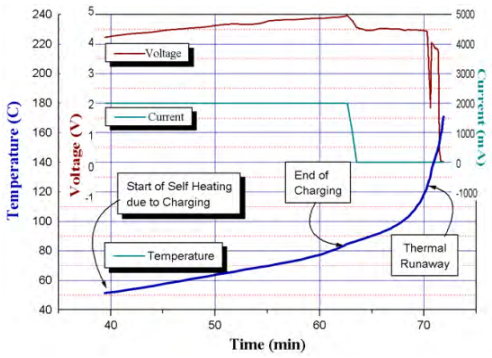


Determine the Heat Capacity of batteries and modules. This knowledge allows conversion of the thermal data (temperature & temperature rate) to heat (Joules) and power (Watts). This allows a direct understanding of heat release to determine heat removal requirements for thermal management.

Request: Heat Capacity Measurement Applications Note

Large Batteries, Modules and Packs

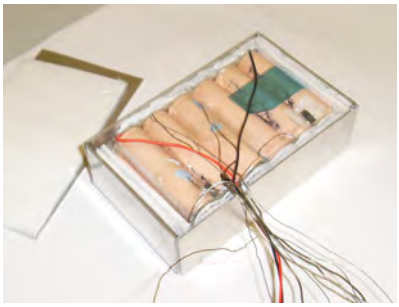
Over-voltage from Ambient Temperature



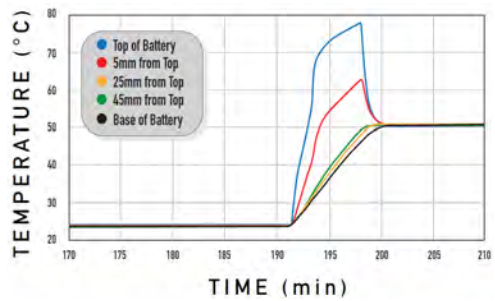
Evaluate larger cells, modules and small packs with larger volume calorimeters. Using the larger size calorimeter to carry out all the tests previously described; safety, stability, use, abuse. THT's pioneering work over the past 10 years has made available the EV Calorimeter and the Battery Performance Calorimeter.

Request: Large Battery ARC Testing Applications Note

Heat Release Distribution



Variation in Temperature Rise over Surface



Use multiple thermocouples positioned over the surface of the battery, module or pack to evaluate the variation of heat release over the surface. This information allows knowledge of the location and amount of heat that must be removed. Thus aiding reliable thermal management

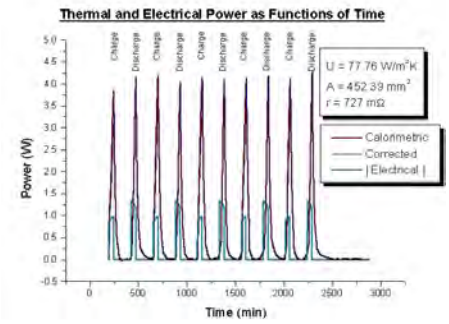
Request: Multipoint Heat Distribution Measurement Applications Note

www.thermalhazardtechnology.com

Applications

EV & Power Applications

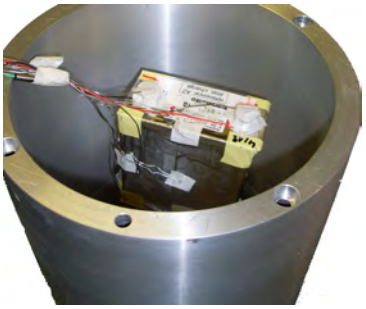
Charge Discharge Cycles



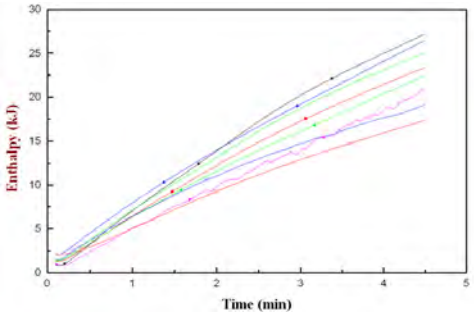
High power discharge from larger cells or modules requires special considerations. Cells or modules must be connected effectively to prevent heat being produced at the connectors. There is also the need to prevent heat loss from the battery along thick low impedance cables. THT has addressed these issues with special clamps and a thermal guard.

Request: EV & Power Applications Note

Calorimetry with Drive Cycle Simulation



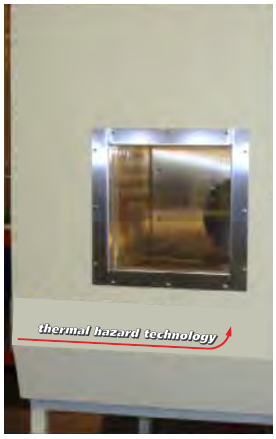
Thermal Distribution with Rapid Discharge



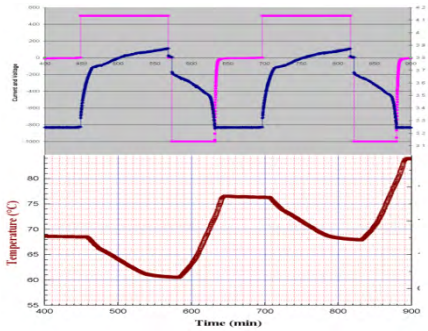
Linking the ARC to an EV / HEV Battery testing system or a d-SPACE computer with appropriate charge/discharge units gives a combined system that allows implementation of high power and driving cycle simulation. This enables the heat generated in the power pack under a drive protocol to be carried out.

Request: Heat Generation from Power Discharge Applications Note

Environmental Testing



Cycles at Varying Environmental Temperatures



Implementing charge/discharge on EV battery at environmental temperatures (-30°C to +60°C) can be simply carried out with the ARC to gain information on the battery's heat release at driving temperature. This option allows the large THT calorimeters to operate isothermally over this temperature range or to be thermally cycled or programmed over these environmental temperatures.

Request: Environmental Testing within the ARC Applications Note

THT in conjunction with several groups around the globe is active in developing new areas of thermal characterisation of lithium batteries.
THT will announce new applications of Battery Calorimetry into the future

Qualified representatives in all major countries. *ARC™ trademark of Thermal Hazard Technology*

Head Office
1 North House • Bond Avenue • Bletchley • MK1 1SW • England
T: +44 1908 646800 F: +44 1908 645209 E: info@thtuk.com W: www.thtuk.com

US Office
Building B • Suite 201a • 100 Jersey Avenue • New Brunswick • NJ 08901
T: +1 732 545 4600 F: +1 732 545 4601 E: info@thtusa.com W: www.thtusa.com

Asia Office
Suite 1416 • 1101 Pu Dong Road (S) • Shanghai 200 120
T: +86 21 5836 2582 F: +86 21 5836 2581 E: info@thtchina.com W: www.thtchina.com

CONTACT US