Detroit Engineered Products (DEP), is an engineering services, product development, software development, consulting, and talent acquisition company. Since its inception in 1998 in Troy, USA, DEP is now a global company with footprints in Europe, China, Korea, Japan, and India. DEP uses the accelerated and transformed product development process, accomplished by utilizing our proprietary platform, DEP MeshWorks, which rapidly reduces the development time of products for all segments. The MeshWorks platform delivers tool sets that accelerate virtual validation activities associated with powertrain development across all stages for both conventional and electric powertrains.

The demand for safe, reliable & high-performing batteries has never been so high. With the world moving closer to more affordable and eco-friendly electric vehicles, manufacturers are looking for batteries with high energy and power density, increased safety, and long life span at a minimum weight, least size and affordable cost. DEP, with our advanced battery design & development solutions, helps customers to design batteries with optimal power-to-weight ratios, specific energy, and density; that can efficiently power the vehicle and its array of supporting electronic systems. As pioneers in the auto industry, we designed techniques that achieve safety and performance goals at reduced developmental costs. Our multi-disciplinary approach for battery product development aids customers in modeling the effects of the design on the battery's safety, performance, capacity & durability. Our expertise covers complex assembly factors by connecting the engineering, manufacturing & quality aspects.

DEP's battery design solutions are based on a holistic approach. It integrates the electro-chemical, mechanical, electrical, controls and software aspects of the design. Our team has extensive expertise in thermal management systems, and can evaluate requirements starting from battery cooling features to temperature distribution and structural chemistry. Our solutions support manufacturers in every phase of the design & development, helping clients maximize battery range with more energy-dense battery structures. Supported by world-class engineering, state-of-art tools, and a wealth of expertise garnered in the mobility segment, we are delivering turn-key solutions that promise to usher in a new transportation era.

Smarter solutions. Realized.

BATTERY SOLUTIONS

Electrification is the most viable way to achieve clean and efficient transportation that is crucial for the sustainable development of the world. In the near future, Electric Vehicles (EVs) including Hybrid Electric Vehicles (HEVs), Plug-in Hybrid Electric Vehicles (PHEVs), and pure Battery Electric Vehicles (BEVs) will dominate the clean vehicle market. The key enabling technology to this revolutionary change is the batteries.

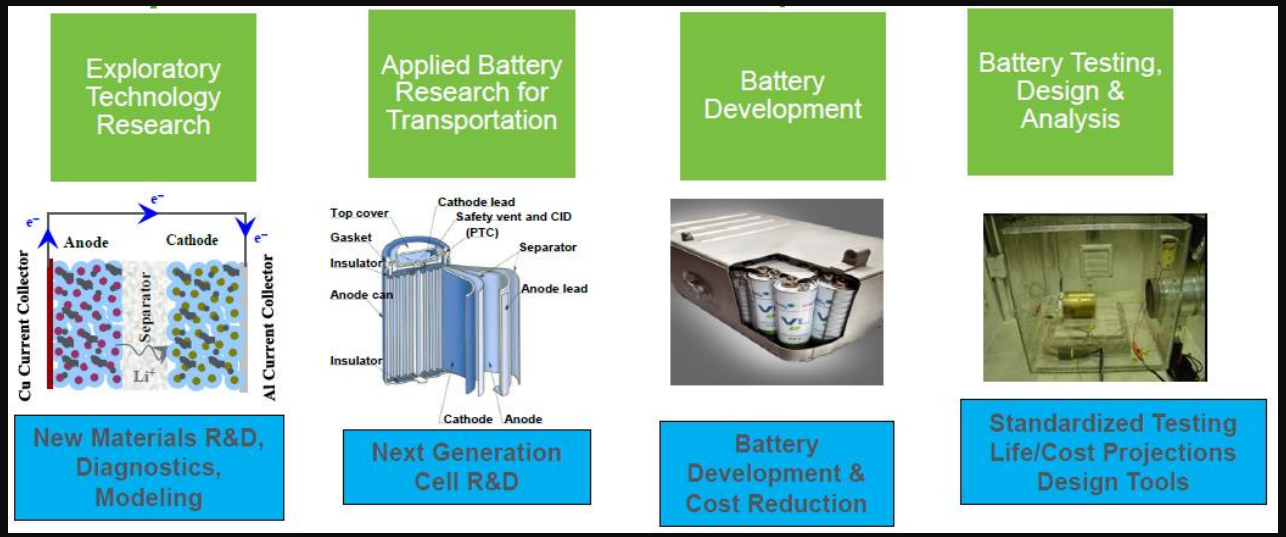
Extensive research efforts and investments are made in this advanced battery technologies that are used in EVs

The uptake of today's EVs has a lot to do with the advent of Lithium battery technology. Lithium-ion batteries are comparatively lightweight, energy dense and can be recharged.

Battery System Level Modelling

CELL – MODULE – PACK - SYSTEM LEVEL (As Applicable)
Detailed Battery Design & Engineering
Reverse Engineering & Testing
Battery Electrochemical Analysis
Battery Thermal/CFD Analysis
Battery Structural Analysis

Battery Management System
Battery Controls



Engineering Support for Battery Systems Development

- The performance and utility of clean energy mobility models like Hybrid Electric Vehicles (HEVs), Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs) primarily depends on the performance and efficiency of the battery package which is the powerhouse for the above means of transport.
- Usage of battery always leads to heat generation and absorption. Therefore, the design and implementation of a successful thermal analysis phase is extremely important in battery manufacturing. With the precise set of outputs we can measure the impact of every aspect of the battery like raw material used, cell designs and the components that form the design during its performance & life cycle.

DEP's key capabilities:

Cell and Module Level Analysis

- Newman Electrochemistry
- Electrochemistry
- Equivalent Circuit Modelling
- Lithium Plating
- Cell Ageing
- Cell Crush
- Thermal Runaway
  - External Heating
  - Nail Penetration
  - Damaged Cell (Module)
- Cell Charging and Discharging
- Cell Over Discharging
- Cell Thermal Analysis

Battery Pack Analysis

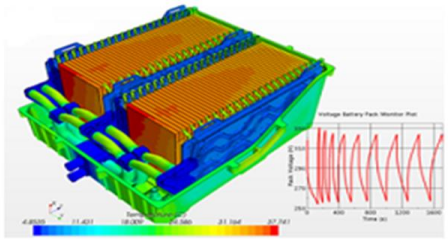
- Equivalent Circuit Modelling (Pack)
- Battery Pack Thermal analysis
- Thermal Runaway-Damaged Cell
- Bus bar- Heat Generation
- Battery Pack Aging analysis

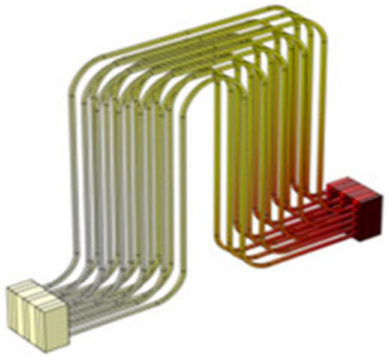
Thermal Analysis

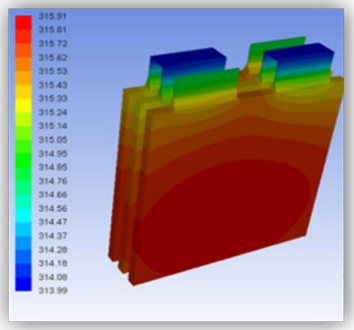
- Hard short
- Max. with-standable voltage
- Ripple & Electro-Thermal
- Pressure drop
- Full pack thermal analysis

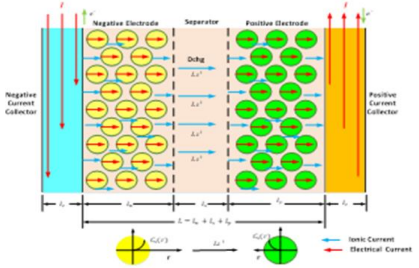
Structural Analysis

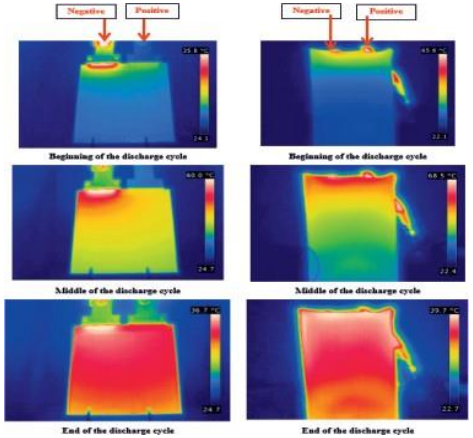
- Torsional and Bending analysis
- Seal analysis
- Housing foot load analysis
- Lift point analysis
- Cell expansion
- Side pole
- Twist ditch analysis
- End plate
- Pot hole
- Bolt sequence analysis
- Random Vibration
- Frontal and Side Impact









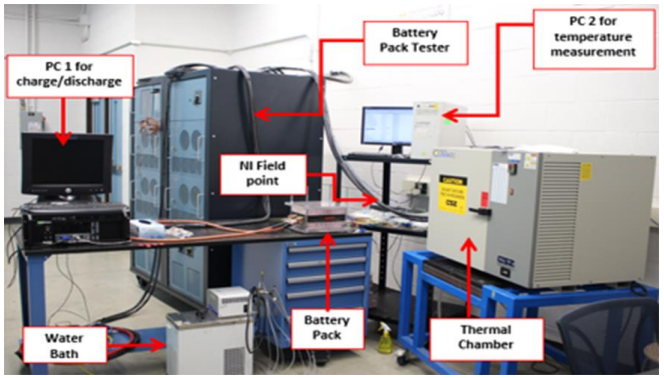


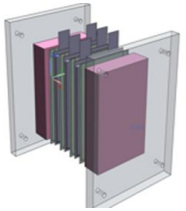
Battery Thermal Testing/Correlation with Simulation

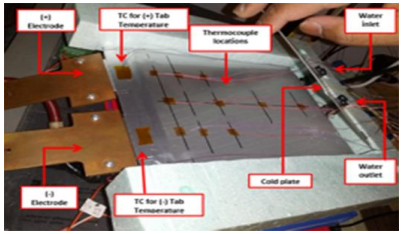
- Battery pack thermal characterization
- Instrumentation with Thermocouples and Heat flux sensors
- IR Imaging
- Battery charge/discharge tests
- Battery degradation tests

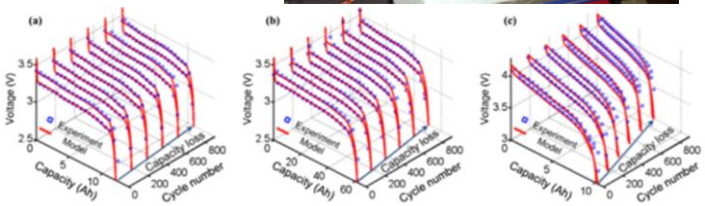
Typical parameters extracted from tear down and rev. Engg.:

- Number of cells
- Number of anode and cathode and separator sheets
- Cold plate design
- Layer unit stack resistance
- Thermal conductivity of +ve and –ve electrode
- Material properties
- 3D scan of battery pack level thermal management system









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