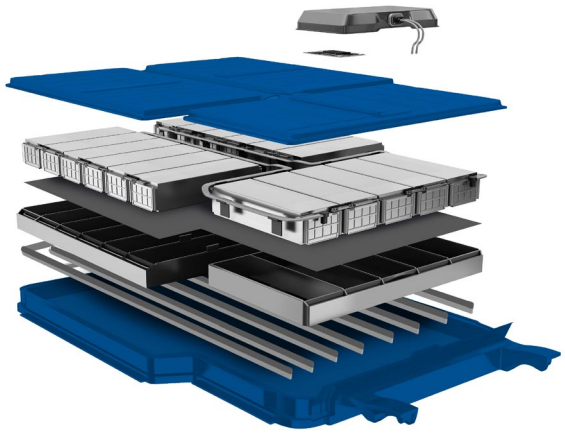
MITSUBISHI CHEMICAL GROUP

Composites for EV Battery Protection

Mitsubishi Chemical Group (MCG) is taking a multi-pronged approach to solving performance and processing challenges in the EV battery segment to help safeguard battery modules and passenger compartments from any impact damage. Our vertically integrated structure and engineering expertise give our customers access to a wider group of over 2,000 R&D innovators at MCG to offer solutions for the EV battery segment in battery protection systems.



Addressing thermal requirements through R&D

Taking an already proven solution to protect classical combustion engines, MCG Advanced Materials elevates our portfolio of thermoplastic composite materials with suitable additives to fulfill the unique requirement of EV.

With the industry ramp-up of EV vehicles, there will be added pressure on an already stretched supply chain to deliver the raw materials needed to produce composites to keep up with vehicle production volumes and EV demand. Additionally, there is an increased request for sustainable materials that can meet the same performance requirements as conventional materials for a similar price point.

We at MCG are well positioned to respond to this trend as our recycled technologies play a key role as an enabler for our thermoset and thermoplastic composite materials that can be used for battery covers or trays, and battery protection plates for thermal runaway requirements to avoid damaging the battery box.

The battery cover takes center stage in the event of a thermal runaway, as it is key to protecting the passengers. It must resist not only the higher temperatures (typically above 800°C) but also cell particles and kinetic energy imparted from the degrading cells into the battery cover.

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To address these challenges, we are developing materials that can resist various thermal conditions, extending from standard operating temperatures to extreme thermal runaway events. This includes characterizing existing materials, using various additives to improve flame resistance, and developing innovative multi-functional materials specifically designed for extreme thermal runaway events beyond the capabilities of metal. We are exploring various fiber reinforcements, resin types, and processing methods. In this effort, it is paramount to be able to meet thermal requirements while also maintaining high structural properties to resist impact damage.

A custom material screening test is also being developed that can replicate the temperatures and energy seen during thermal runaway events in a simple setup, without high costs or the complexity of using an actual EV battery. If the material passes this screening, it will move on to the full-scale battery test. This material screening is being considered by major OEMs.

| Product Spotlight

MCG is characterizing existing materials and developing innovative multifunctional materials to withstand thermal runaway events, like a new flame-retardant thermoplastic composite for battery enclosures that are passed five-plus minutes' exposure to a 1,000°C flame.

- **GMT/GMTex™GMT |** is a flame-retardant battery protection material to address flammability concerns with EV batteries. This material has shown a long retaining ductility at lower temperatures which are independent of the engine of the cars.
- **Carbon Fiber Forged Molding Compound (CF-FMC™) |** has properties preferred to be used for battery covers, which are excellent flame retardancy, dimensional stability, heat resistance, and chemical resistance. Hybrid parts can be co-molded easily with different materials, such as continuous fiber for additional reinforcement, a barrier layer for extra flame protection, and a conductive layer for electromagnetic shielding.