

More safety for lithium-ion batteries – with silicones from Wevo

Ostfildern-Kemnat, Germany. One of the most important requirements for batteries in electric vehicles is the ability to mitigate thermal runaway. This is defined as protection against overheating through a self-reinforcing, exothermic process and cushioning the effects should this happen nevertheless. Apart from mechanical stability through good vehicle design and cooling management, thermal stability of the battery is key. However, the materials used to achieve this should not only prevent the spread of overheating but must simultaneously take account of design freedom, weight and fitness for production processes. To mitigate thermal runaway propagation, WEVO-CHEMIE GmbH has developed a portfolio of silicone-based materials for battery modules and packs that serve as strong thermal, mechanical and electrical barriers. In addition to very high heat and flame resistance, the tailor-made formulation offers further advantages, for example, the reduced total weight compared with mineral or metal filled compounds and the avoidance of outgassing in the production process compared with foams.

Although thermal runaway of individual battery cells is rare, once it is set in motion it poses enormous threats, especially in vehicles and storage technologies for private households. This is because the typical failure mode involves violent exothermic decomposition reactions that generate so much heat that it can no longer be dissipated by the thermal management solution of the battery module containing the defective cell. If this effect propagates to other cells, the result could be a fire or even an explosion at the level of the module or pack. Since thermal runaway of individual cells cannot be completely avoided, the goal here is to create unfavourable conditions for its occurrence, mitigate the ensuing hazards and contain the effects.

For this purpose, various safety measures must be considered when designing battery modules and packs. These include controlled venting of the individual cells and hence the contained release of the gases produced, as well as the installation of fuse-like mechanisms. In order to prevent the reaction from one defective cell from propagating to neighbouring cells and in doing so mitigate the effects of thermal runaway, Wevo has developed special silicone-based materials.

Wevo solutions support the mitigation of thermal runaway

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WEVOSIL 27001 FL has been proven in field tests by Wevo customers to be a highly efficient mechanical and thermal barrier that can be applied both above and between cells, depending on the cell type. The material achieves very high heat and flame resistance without any mineral or metallic fillers having to be incorporated. This has helped to keep its specific gravity low, thus also contributing to a lightweight battery design. Its excellent electrical insulation properties play a crucial role in preventing a short circuit in the module's cell contacting system when applied to critical locations and circuits.

From a mechanical point of view, WEVOSIL 27001 FL is much more flexible than mineral solutions and a lot stronger than foamed materials. In addition, it has a very low volatile content because only state-of-the-art polymers that have been thoroughly degassed during a separate step of their manufacturing process are used in its formulation. This is a clear answer to the outgassing concerns of the automotive industry, raised by older generations of silicone materials. Also, different flow requirements can be met with the lower viscosity WEVOSIL 22027 FL variant, which complements the slightly thixotropic WEVOSIL 27001 FL for coating solutions. Both materials are equally suitable for the production of prefabricated rubber pads and for manual or automated in-situ dispensing.

Silicones from Wevo enable efficient thermal management of batteries

The battery management system can also be employed to mitigate the propagation of thermal runaway, as can a carefully considered design of the thermal management solution for the battery module and pack. The thermally conductive gap fillers in the WEVOSIL 260XX FL series – especially developed for this purpose – also include grades of extra-low density and weight, all of them certified according to the UL 94 V-0 flammability rating. At the same time, high dimensional stability is ensured and there are no curing by-products, due to the use of addition curing chemistry. By default, this enables room temperature curing at the desired speed, meaning that heat curing is not necessary, although heat can greatly accelerate the process if required.

If these tailor-made Wevo solutions are implemented in an early development phase, the overall safety of battery modules can be significantly improved by optimising thermal management for specific applications, and customising the configuration of thermal, mechanical and electrical barriers.

Image description and source

Among the advantages of Wevo silicones are their very high heat and flame resistance (Image source: WEVO-CHEMIE GmbH).

Press information

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Note

The Wevo silicones are also being presented at the Silicone Expo currently taking place in Amsterdam – at the Wevo booth 129 and during our presentation at the conference at 3.40 p.m. on 21 March.

About Wevo

WEVO-CHEMIE GMBH is an international, independent, family-run chemicals company headquartered in Germany and with further companies in Asia, China and the USA. Wevo develops and manufactures innovative potting applications as well as special bonding and sealing applications based on polyurethane, epoxy and silicone – primarily for applications in electrical and electronic components. Wevo products protect sensitive components against chemicals, vibration, foreign bodies, dust, moisture and high temperatures.

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