

MARKETS // PRODUCTS



# BATTERY SOLUTIONS

A close-up photograph of a metal tray containing several pink cylindrical batteries. A grey tool is positioned vertically in the foreground, slightly out of focus. The batteries are arranged in a grid pattern. The tray is set against a blurred background.

**vonRoll**

# NEXT-GENERATION ADHESIVE PRODUCTS FOR BATTERY APPLICATIONS

## How to improve heat dissipation, productivity and lifetime performance of battery modules and packs

As the current trend is moving away from conventional ICE (Combustion Engine) power train systems to fully or hybrid electric systems, there is a strong demand and need for next-generation materials for the 48V, 400V and 800V battery platforms. Von Roll is specialized in electrical isolation materials like impregnation, potting and coating resins but also in flexible laminates for electrical, electronics and battery applications. For all type of batteries, we are historically known for cell-spacers technology based on mica-chemistry and adhesive systems.

Generally, a distinction is made between two different adhesive technologies: self-levelling adhesives and thermal adhesives.

## SELF-LEVELLING ADHESIVES

**Self-levelling adhesives** are also often called “potting adhesives” – as the name suggests. They are low-viscosity adhesives used in the battery pack assembly for various purposes:

- + Ideal combination of gap filling and cell fixation
- + Thermal and Mechanical shock damping
- + Homogeneous heat dissipation
- + Shorter production cycles
- + No need for additional gap fillers materials

On the module level, our self-levelling adhesives are mainly used for three different applications. As **venting cap protection**, they are very effective against corrosion and promote controlled expelling of venting gas with reduced fire risk while also fixing and protecting bonding wiring. When used for **bottom part fixation**, self-levelling adhesives offer excellent heat dissipation, shock damping, and increased crash stability without the need for gap filler or structural adhesives. In a **full potting** scenario, self-levelling adhesives provide the highest-level module protection with the most effective homogeneous heat dissipation, thermal runaway protection, and ultimate shock damping.



For high-volume productions, a combination of venting cap protection and bottom part fixation potting can be a very effective solution because there is no need for additional products like gap-fillers, gap-pads, structural adhesives, or mechanical fixation. For further information on this all-round approach, look at the following videos:



Dosing of Damival® U602 in Battery Module



Dosing of Damival® U602 in E-Bike Batteries

Damival® U602 is the new name of Damival® 13682.

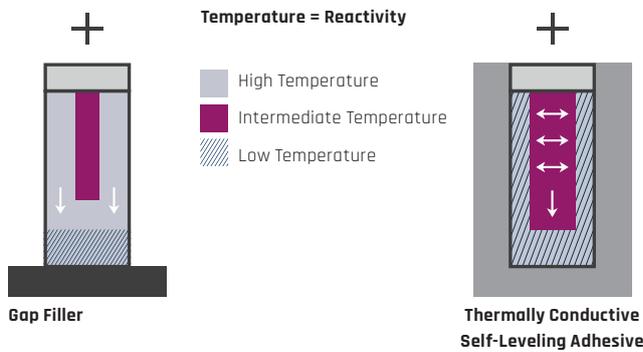


Figure 1: Comparison of heat dissipation between gap-filler and our Damival U60X Series

To demonstrate the heat dissipation effect of our self-levelling adhesives, we performed thermographic comparisons of the heat flow in single battery cells. A significantly more homogeneous temperature distribution than conventional gap filler, foam or gap-pad was achieved.

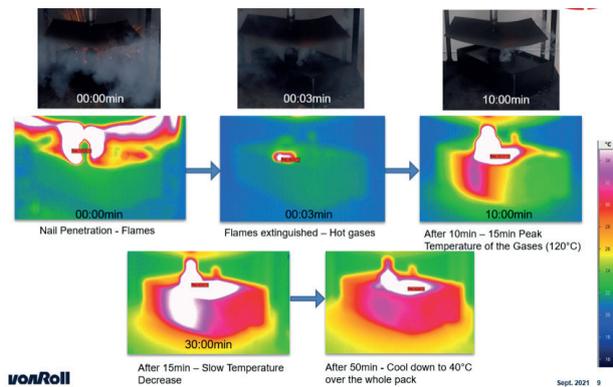


Figure 2: Thermal runaway test of a fully potted module with Damival® U602

For the potting U60X Series, the thermal runaway behaviour has been tested in fully potted high-voltage battery modules. The result: below the potted areas without oxygen access, no reaction could be observed - flames were extinguished in 3 Seconds. The thermal runaway was also slowed down significantly - after 15min, the superior heat dissipation already produced a marked decrease in maximum temperature, which went down further to below 40°C after 50min. The full and detailed report is available on request.

## NEXT LEVEL: THE DAMIVAL U60X SERIES

Tested, proven, and certified for battery applications, this resin is Eco-friendly, thanks to the use of next-generation polyurethane (Health and Safety friendly). As a high temperature resistant Polyurethane, outgassing-free alternative to silicone potting materials, it is suitable for use from -40°C up to 150°C, highly elastic up to 200% elongation, and exhibits excellent thermal shock behaviour. With a wide range of approvals, this product is non-flammable, self-extinguishing (UL94 V0 classified), with low smoke emissions (EN45545-2 HL3 approved) and classified as a non-dangerous good for easy transport. The overall versatile material is suitable for a range of applications from PCB-potting (Printed Circuit Boards) to use as an adhesive.



## THERMAL ADHESIVES

**Thermal adhesives** are also known as thermal glues and are mainly used for the mechanical fixation and thermal connection of modules or packs to the cooling system. They can provide additional sealing to prevent moisture migration which could affect the long-term performance of the battery.

- + Fixation on module/pack level for thermal connection to the cooling system
- + Thermal & mechanical shock damping
- + Good adhesion on a broad substrate spectrum
- + Higher productivity – mechanical fixation replacement and extra sealing
- + High thermal conductivity over 2.5 W/mK for heat dissipation

Thermal adhesives are suitable for use on modules or packs in all used-cell technologies like prismatic, pouch or cylindrical cells.

At the **module level**, thermal adhesives provide cell bonding and fixation, connect the cells to the cooling system, and support module sealing. When used for fixation at the **pack level**, the modules are mechanically bonded to the pack, the BMS (Battery Management System) unit is secured, a connection to the pack cooling system is established, and the battery pack gets additional sealing. As a **thermal glue** in other applications, the adhesive can serve to fix BMS units and cell stacks, provide homogenous heat dissipation, dampen shocks, enhance crash stability, and function as a seal against humidity and moisture.

## NEXT LEVEL: THERMAL ADHESIVES BASED ON DAMIVAL SERIES

Tested and proven in battery applications, this is a health & safety-friendly adhesive, thanks to the use of next-generation polyurethane (health and safety friendly). As a non-silicone, outgassing-free alternative to silicone potting materials, it is suitable for use up to 150°C. This highly flexible resin, exhibits excellent thermal shock behaviour, and, in addition to its high thermal conductivity of 2.5W/m.K, its low glass transition temperature (below -45°C) allows keeping high elasticity even at low temperature. Non-flammable, self-extinguishing and classified as a non-dangerous good, it is easy and safe to transport.

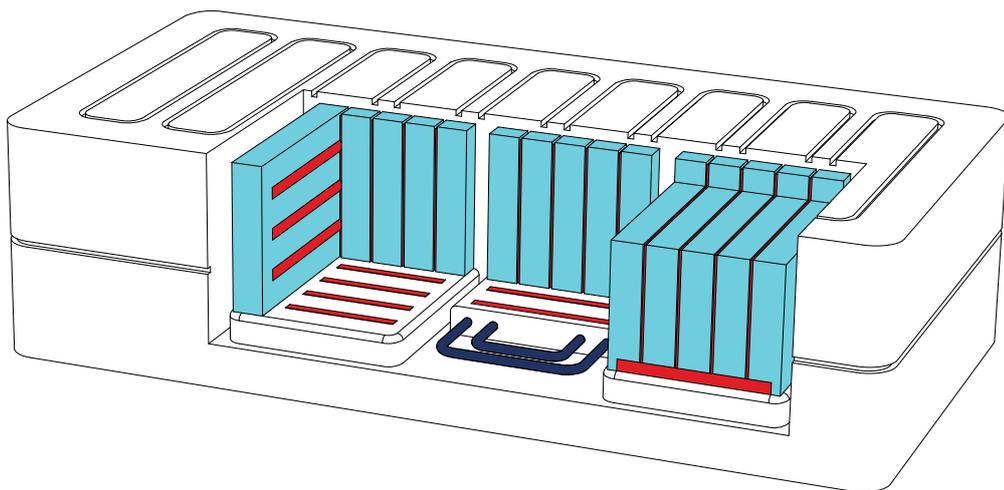


Figure 3: Battery module of prismatic cells with thermal adhesive (red) used

As one of the oldest industrial companies in Switzerland, founded in 1803, we focus on products and systems for power generation, transmission and distribution, rotating machines and mechanical engineering. Von Roll is the global market leader for insulation products and the only company to offer the complete range of insulation products, composites, consulting, tests and services for the electrotechnical industry.

For more than 100 years, we have been making outstanding contributions to this market, developing a number of highly innovative products that have enabled both steady increases in power output and smaller and more compact machines.

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