

PyroBubbles

New Packing Concept for Lithium-ion Batteries

Lithium-ion batteries are gaining ground. The range of possible applications is virtually endless and the future of a modern information society without them seems inconceivable. Lithium batteries are generally considered safe. The development dynamics have increased the complexity and severely changed the number of different types as well as the chemical specifications. It is common knowledge that lithium batteries potentially exhibit “high inertia”. This means that several days could pass between the actual damaging event and a possible thermal runaway. Energy density, self-ignition potential, overload (severe temperature increase due to exothermal events), total discharge or the loss of electrolyte: The hidden risks may not be underestimated. Risks are particularly due to faulty usage, improper handling or errors during production. Chemical reactions of the electrolyte may also cause extremely caustic hydrofluoric acid (HF) as well as highly inflammable and partially poisonous organic connections. As the chemical reactions of the lithium cells are exothermic, it is possible that the reaction of one cell “infects” the neighbouring cells. Alexander Lehmann, Chairman at Fire-Shield I AG also describes this infectious effect of a lithium cell as a “domino effect”, because it is possible that the neighbouring cells are “infected”, causing the entire module and/or the entire battery to burn down; this event is called thermal runaway.

Logistics and particularly hazardous goods transport are aware of several packaging methods for critical lithium-ion batteries. With the increasing volume of lithium-ion batteries in all industrial sectors, conventional packaging methods are facing the problem that the rapidly increasing distribution of modern energy storages and their packaging shall at times only be possible under considerable expenditures. Accordingly, the objective was to create a practical standard packaging method in compliance with international regulations. The most important components of the packaging method include an approved transport container, specially positioned pressure valves, inert filler and the all-round cover with PyroBubbles to surround a defect or damaged lithium battery. The central component for the protection in case of thermal runaway is the inert filler PyroBubbles. PyroBubbles is a fire protection agent examined by the German test institute MPA Dresden in accordance with DIN EN 3-7 suitable for solid and liquid inflammable substances (Fire class A, B, D and F). PyroBubbles are extremely light (bulk density approx. 235kg/m³), has a porous surface and an average corn size of 0.5 – 5 mm. PyroBubbles is water neutral, food safe and recyclable. As PyroBubbles are chemically inert and electrically insulated, they contain the risk potential of lithium-ion batteries well.

The also withdraw a lot of heat from the runaway lithium-ion batteries as well as the released liquids and gases due to their high specific heat capacity. The porosity allows a high electrolyte absorption capacity of 2.5 l/kg and the dense “packing” around the battery inhibits material transport and allows for the condensation of vapours. The decisive criterion for its protective character is the all-round cover with PyroBubbles surrounding the defect or damaged module. The fact that batteries can be packaged quickly and safely is one very special feature of the PyroBubbles-LIONGUARD packaging system. Neither separate internal packaging nor additional measures to secure the position are required. The packaging can be used until a critical event occurred. Up to this time the system can be reused any number of times and is practically maintenance-free. Following a critical event, the box can simply be recycled. Various lithium-ion batteries, pouch cells, e-bike batteries as well as individual modules and entire battery systems up to 140 kg from the automobile sector were subjected to extensive test during numerous experiments.

The PyroBubbles-LionGuard packaging method provides packaging which complies with the regulations for the transport of critical lithium batteries in terms of a thermal runaway, which has been approved by the Federal Institute of Material Research and Testing, BAM. In this context, Alexander Lehmann states “that the PyroBubbles-LionGuard product family was expanded by a so-called Box in Box System which, for the first time, permits the collection and transport of lithium batteries with different chemical compositions, energy densities and weight in accordance with the regulations. This is the complete solution for retail trade and industry. Functioning circuits and recycling processes will contribute significantly to the safety as well as the preservation of resources in the future.



Image courtesy of Fire-Shield AG



For further information, go to www.fire-shield.de