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Packaging – Materials Review

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Abstract. Nowadays, a large number of different electrochemical energy storage systems are known. In the last two decades the development was strongly driven by a continuously growing market of portable electronic devices (e.g. cellular phones, lap top computers, camcorders, cameras, tools). Current intensive efforts are under way to develop systems for automotive industry within the framework of electrically propelled mobility (e.g. hybrid electric vehicles, plug-in hybrid electric vehicles, full electric vehicles) and also for the energy storage market (e.g. electrical grid stability, renewable energies).

Besides the different systems (cell chemistries) electrochemical cells and batteries were developed and are offered in many shapes, sizes and designs, in order to meet performance and design requirements of the widespread applications. Proper packaging is thereby one important technological step for designing optimum, reliable and safe batteries for operation.
In this contribution, current packaging approaches of cells and batteries together with the corresponding materials are discussed. The focus is laid on rechargeable systems for industrial applications (i.e. alkaline systems, lithium ion, lead acid).

In principle, four different cell types (shapes) can be identified – button, cylindrical, prismatic and pouch. Cell size can be either in accordance with international (e.g. International Electrotechnical Commission, IEC) or other standards or can meet application-specific dimensions. Since cell housing or container, terminals and, if necessary, safety installations as inactive (non-reactive) materials reduce energy density of the battery, the development of low-weight packages is a challenging task. In addition to that, other requirements have to be fulfilled: mechanical stability and durability, sealing (e.g. high permeation barrier against humidity for lithium-ion technology), high packing efficiency, possible installation of safety devices (current interrupt device, valve, etc.), chemical inertness, cost issues, and others.

Finally, proper cell design has to be considered for effective thermal management (i.e. cooling and heating) of battery packs.