GlobTek Batteries and Battery Packs www.globtek.com
GlobTek Batteries and Battery Packs www.globtek.co.uk
GlobTek Batterien und Akkupacks www.globtek.de
GlobTek Batteries et packs batteries www.globtek.fr

Lithium Polymer Battery Packs

The lithium-polymer differentiates itself from conventional battery systems in the type of electrolyte used. The original design, dating back to the 1970s, uses a dry solid polymer electrolyte.

This electrolyte resembles a plastic-like film that does not conduct electricity but allows ions exchange (electrically charged atoms or groups of atoms). The polymer electrolyte replaces the traditional porous separator, which is soaked with electrolyte.

The dry polymer design offers simplifications with respect to fabrication, ruggedness, safety and thin-profile geometry. With a cell thickness measuring as little as one millimeter (0.039 inches), equipment designers are left to their own imagination in terms of form, shape and size.

Unfortunately, the dry lithium-polymer suffers from poor conductivity. The internal resistance is too high and cannot deliver the current bursts needed to power modern communication devices and spin up the hard drives of mobile computing equipment. Heating the cell to 60°C (140°F) and higher increases the conductivity, a requirement that is unsuitable for portable applications.

To compromise, some gelled electrolyte has been added. The commercial cells use a separator/ electrolyte membrane prepared from the same traditional porous polyethylene or polypropylene separator filled with a polymer, which gels upon filling with the liquid electrolyte. Thus the commercial lithium-ion polymer cells are very similar in chemistry and materials to their liquid electrolyte counter parts.

Lithium-ion-polymer has not caught on as quickly as some analysts had expected. Its superiority to other systems and low manufacturing costs has not been realized. No improvements in capacity gains are achieved - in fact, the capacity is slightly less than that of the standard lithium-ion battery.

Lithium-ion-polymer finds its market niche in wafer-thin geometries, such as batteries for credit cards and other such applications.

Advantages

- **Very low profile** - batteries resembling the profile of a credit card are feasible.
- **Flexible form factor** - manufacturers are not bound by standard cell formats. With high volume, any reasonable size can be produced economically.
- **Lightweight** - gelled electrolytes enable simplified packaging by eliminating the metal shell.
- **Improved safety** - more resistant to overcharge; less chance for electrolyte leakage.

☎+1 201 784 1000
☎+44 (0) 560 105 7817
☎+49 251 134 963 71
☎+33 (0) 547 480 129

Limitations

- Lower energy density and decreased cycle count compared to lithium-ion.
- Expensive to manufacture.
- No standard sizes. Most cells are produced for high volume consumer markets.
- Higher cost-to-energy ratio than lithium-ion
- Restrictions on lithium content for air travel

Air travelers ask the question, “How much lithium in a battery am I allowed to bring on board?” We differentiate between two battery types: Lithium metal and lithium-ion.

Most lithium metal batteries are non-rechargeable and are used in film cameras. Lithium-ion packs are rechargeable and power laptops, cellular phones and camcorders. Both battery types, including spare packs, are allowed as carry-on but cannot exceed the following lithium content:

- 2 grams for lithium metal or lithium alloy batteries
- 8 grams for lithium-ion batteries

Lithium-ion batteries exceeding 8 grams but no more than 25 grams may be carried in carry-on baggage if individually protected to prevent short circuits and are limited to two spare batteries per person.

How do I know the lithium content of a lithium-ion battery? From a theoretical perspective, there is no metallic lithium in a typical lithium-ion battery. There is, however, equivalent lithium content that must be considered. For a lithium-ion cell, this is calculated at 0.3 times the rated capacity (in ampere-hours).

Example: A 2Ah 18650 Li-ion cell has 0.6 grams of lithium content. On a typical 60 Wh laptop battery with 8 cells (4 in series and 2 in parallel), this adds up to 4.8g. To stay under the 8-gram UN limit, the largest battery you can bring is 96 Wh. This pack could include 2.2Ah cells in a 12 cells arrangement (4s3p). If the 2.4Ah cell were used instead, the pack would need to be limited to 9 cells (3s3p).

Restrictions on Shipment of Lithium-ion Batteries

Anyone shipping lithium-ion batteries in bulk is responsible to meet transportation regulations. This applies to domestic and international shipments by land, sea and air.

Lithium-ion cells whose equivalent lithium content exceeds 1.5 grams or 8 grams per battery pack must be shipped as “Class 9 miscellaneous hazardous material.” Cell capacity and the number of cells in a pack determine the lithium content.

Exception is given to packs that contain less than 8 grams of lithium content. If, however, a shipment contains more than 24 lithium cells or 12 lithium-ion battery packs, special markings and shipping documents will be required. Each package must be marked that it contains lithium batteries.

www.globtek.com
www.globtek.co.uk
www.globtek.de
www.globtek.fr

All lithium-ion batteries must be tested in accordance with specifications detailed in UN 3090 regardless of lithium content (UN manual of Tests and Criteria, Part III, subsection 38.3). This precaution safeguards against the shipment of flawed batteries. Cells & batteries must be separated to prevent short-circuiting and packaged in strong boxes.

Nickel Metal Hydride Battery Packs

Rechargeable NiMH batteries offer many advantages, especially in high-drain portable device applications. NiMH batteries are a complex mix of nonhazardous chemicals and materials providing storable energy in a convenient package. The internal materials of a NiMH battery efficiently absorb, release, and transport hydrogen to and from its electrodes.

The key to NiMH technology is in the negative electrode's hydrogen-absorbing alloys, which contribute to the high energy density of that electrode, which results in an increase in the volume available for the positive electrode. This is the primary reason for the higher capacity, longer service life, and lack of voltage depression (memory effect) of the NiMH battery over some competing rechargeable battery technologies, such as NiCd.

With continuing research and development, the NiMH chemistry is now available in almost all the standard cell sizes and configurations. These include a wide range of cylindrical cells (AAA, AA, A, C, D, F, and M), prismatic, and button cells. These batteries can also be assembled in a wide range of battery pack configurations to meet the increasing demands for portability in electronic equipment.

NiMH cells are ideally suited for high drain applications such as portable printers, medical devices, telecommunications equipment, computers and digital cameras. The lifetime cost of NiMH cells vs. alkaline is significantly lower, with the user needing over 7,000 alkaline batteries to match the performance of a single NiMH cell.

When compared to NiCd batteries, the NiMH cell has more than twice the capacity per charge, and can be charged more times. Further, the NiCd battery contains cadmium, a harmful element that makes NiCd cells dangerous to throw away and costly to recycle.

Sealed Lead-acid Battery Packs

Stationary batteries are designed to provide electrical power to systems during instances of power outages. They are used in equipment dedicated to stabilizing voltages by eliminating irregularities in systems that generate electrical power. The batteries can hold large loads temporarily as utility power switches from one generation source to another. Hence, applications such as uninterruptible power supplies, DC power systems, emergency lighting, security alarm, and switchgear primarily drive the market for stationary batteries.

Sealed lead acid batteries are utilized for wide variety of applications including vehicular electronics, UPS and computer systems, wheelchairs, scooters, industrial and medical equipment and more. Sealed lead-acid (SLA) battery packs are best suited for applications where size and weight are not important considerations. Due to low energy density characteristics, SLA battery packs are bulky and heavy, and are often used in stationary or wheeled applications such as emergency lighting systems or electric wheelchairs that require higher power.

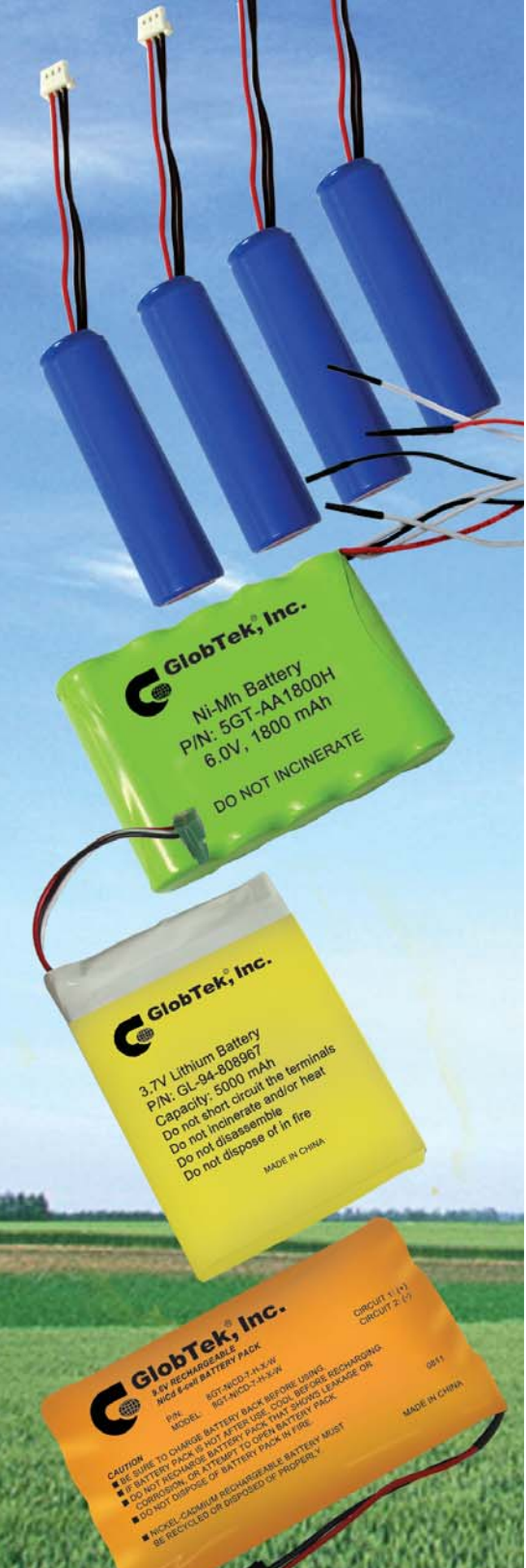
In comparison to other chemistries, SLA battery packs are very cost effective and easy to maintain. In addition, they have a low self-discharge rate, giving them a long shelf life.

In-House Capabilities

- Battery Pack design
- Battery Management Circuit Design
- Performance Verification
- Custom Charger Development
- Battery Pack Assembly
- PCB Assembly
- Mechanical Design and fabrication of Plastic and/or metal parts or enclosures
- Production Testing
- Environmentally controlled Storage
- Regulatory Approvals
- Transportation Testing such as UN38.3 Test

☎+1 201 784 1000
☎+44 (0) 560 105 7817
☎+49 251 134 963 71
☎+33 (0) 547 480 129

www.globtek.com
www.globtek.co.uk
www.globtek.de
www.globtek.fr



- Lithium ion battery packs
- Lithium polymer battery packs
- Nickel metal hydride battery packs
- Nickel Cadmium
- Sealed lead-acid battery packs
- Lithium Manganese dioxide batteries
- Lithium Sulfur dioxide batteries
- Lithium Thionyl chloride batteries
- Alkaline batteries

Batteries

As a leader in the design, integration, and manufacture of custom battery packs and battery chargers, GlobTek enables portable electronic products to be more dependable, smaller, lighter, and longer running. GlobTek's team of design engineers develops complete power solutions based on customer requirements to help them achieve their system goals quicker and more effectively.

Battery Packs: Custom Design and Assembly

Power quality has emerged as a much discussed topic within the last ten years and is anticipated to remain a critical factor as more applications become microprocessor-based. With increased dependency upon electronics, the need and requirement for power quality is not expected to cease.

Customers can rely on GlobTek to design safe and reliable custom battery packs from simple Sealed lead-acid batteries to complex Lithium ion packs including electronic safety, monitoring, and charge control circuitry. Our extensive experience in power supply products, plastic housings, interconnects, and electronic circuitry gives us a tremendous competitive advantage over battery assemblers who outsource many of the key processes required to build a state-of-the-art portable power source.

GlobTek's ability to match our custom battery packs to a custom battery charger designed for each specific application also keeps our customers a step ahead of the competition. We design and optimize both battery pack and battery charger during the design phase to provide the best possible performance.

Lithium ion Battery Packs

Lithium ion (Li-ion) battery packs are the preferred power source for handheld devices due to their small size and light weight. Li-ion battery packs have no “memory effect” (also known as voltage depression), common in older cell chemistries. With a higher energy density than Nickel-based battery packs and a low self discharge rate, Li-ion battery packs have revolutionized the design of portable devices that were previously restricted by power source size, weight, and run-time limitations.

Due to the more volatile nature of Lithium, versus Nickel battery packs and high energy density, every Lithium battery pack is designed with special attention to safety considerations, from the design phase to volume manufacturing.

Lithium-ion is a low maintenance battery, an advantage that most other chemistries cannot claim. There is no memory and no scheduled cycling is required to prolong the battery's life. In addition, the self-discharge is less than half compared to nickel-cadmium, making lithium-ion well suited for modern fuel gauge applications. Lithium-ion cells cause little harm when disposed.

Despite its overall advantages, lithium-ion has its drawbacks. It is fragile and requires a protection circuit to maintain safe operation. Built into each pack, the protection circuit limits the peak voltage of each cell during charge and prevents the cell voltage from dropping too low on discharge. In addition, the cell temperature is monitored to prevent temperature extremes. The maximum charge and discharge current on most packs are is limited to between 1C and 2C. With these precautions in place, the possibility of metallic lithium plating occurring due to overcharge is virtually eliminated.

Aging is a concern with most lithium-ion batteries. Some capacity deterioration is noticeable after one year, whether the battery is in use or not. The battery frequently fails after two or three years. It should be noted that other chemistries also have age-related degenerative effects. This is especially true for nickel-metal-hydride if exposed to high ambient temperatures. At the same time, lithium-ion packs are known to have served for five years in some applications.

Manufacturers are constantly improving lithium-ion. New and enhanced chemical combinations are introduced every six months or so. With such rapid progress, it is difficult to assess how well the revised battery will age.

Storage in a cool place slows the aging process of lithium-ion (and other chemistries). Manufacturers recommend storage temperatures of 15°C (59°F). In addition, the battery should be partially charged during storage. The manufacturer recommends a 40% charge.

The most economical lithium-ion battery in terms of cost-to-energy ratio is the cylindrical 18650 (18 is the diameter and 650 the length in mm). This cell is used for mobile computing and other applications that do not demand ultra-thin geometry. If a slim pack is required, the prismatic lithium-ion cell is the best choice. These cells come at a higher cost in terms of stored energy.

Advantages

- High energy density - potential for yet higher capacities.
- Does not need prolonged priming when new. One regular charge is all that’s needed.
- Relatively low self-discharge - self-discharge is less than half that of nickel-based batteries.
- Low Maintenance - no periodic discharge is needed; there is no memory
- Specialty cells can provide very high current to applications such as power tools.

Limitations

- Requires protection circuit to maintain voltage and current within safe limits.
- Subject to aging, even if not in use - storage in a cool place at 40% charge reduces the aging effect.
- Transportation restrictions - shipment of larger quantities may be subject to regulatory control. This restriction does not apply to personal carry-on batteries. (See last section)
- Expensive to manufacture
- Not fully mature - metals and chemicals are changing on a continuing basis.

Typical Applications

- Portable medical equipment
- Handheld electronics
- Safety and security
- Military and aerospace
- Power Tools and Appliances
- Communications
- Consumer Electronics
- Data Collection
- Electric Vehicles
- Rechargeable Household and Commercial Products
- Test and Measurement Devices
- UPS Systems

Battery Formulation Performance

Cell Type	Vdc	Recharges	Watts/Liter	Price Ratio	Issues
NiMH	1.2	500 to 1,000	300	100%	None
NiCd	1.2	300 to 500	134	80%	Memory, disposal
Li-Ion	3.6	300 to 400	287	200%	Safety/fire, disposal

☎+1 201 784 1000
☎+44 (0) 560 105 7817
☎+49 251 134 963 71
☎+33 (0) 547 480 129

www.globtek.com
www.globtek.co.uk
www.globtek.de
www.globtek.fr

Custom Energy Systems

Power Supply Solutions, Standard and Custom

ENERGY STAR PARTNER