Preshaped Li-ion Batteries

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Introduction

Lithium-ion batteries are nowadays employed in a wide range of portable products. However, the shape of present-day Li-ion batteries is limited to cylindrical and prismatic, thereby seriously restricting the use of space inside the portable equipment. The call for Li-ion batteries with different shapes has induced the invention of the Lithylene^{TM1} technology within the Philips Research Laboratories. With this technology, preshaped batteries can be made, which perfectly fit into, *e.g.* the void space of the electronic equipment, offering a much larger degree of product design freedom.

Lithylene^{TM} technology

The principle of the Lithylene technology is as follows: two single-sided positive electrodes are placed on either side of a double-sided negative electrode with separators in between. Each of these electrodes has already been punched with small holes. A thin sheet of rivet polymer is then applied to the outside of each outside electrode and, under specified heating and pressure conditions, the polymer penetrates each of the holes, and once it cools it hardens, keeping the cell's active materials together and providing a very stable battery structure. Multi-stacks can also easily be made.

Experimental and results

The Li-ion batteries are made of commercial $LiCoO_2$ positive electrodes, graphite negative electrodes and separators. For a 700mAh flat Li-ion battery (Fig. 1a), its dimension is 3.6×35×62 mm with a weight of 15.5g. For the shaped battery (Fig. 2), it perfectly fits into the housing of a portable product. Meanwhile it saves 70% in weight and 61% in volume in comparison with its NiMH counterpart.

The Li-ion batteries are first formed using a CCCV regime. It starts to charge at 0.2 C till 4.2 V, the voltage is then kept constant until the current drops to 0.05 C. After a resting period of 30 min, the batteries start to discharge at 0.2 C till the cut-off voltage of 3 V is reached. Afterwards, the batteries are subjected to rate capacity tests to get a general understanding of their performance. The results are shown in Fig 3. The discharge at 0.2C shows the capacity of 750mAh.

Conclusion

The preshaped Li-ion batteries reveal a high energy density, and most importantly they offer a large degree of shape flexibility.

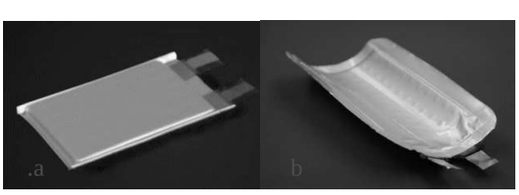


Fig. 1 700mAh flat (a) and curved (b) Lithylene battery

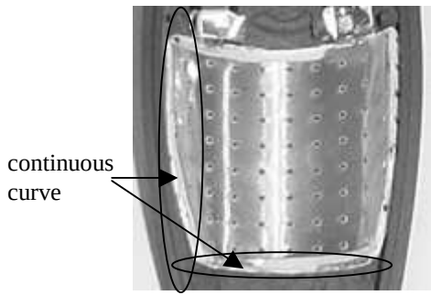
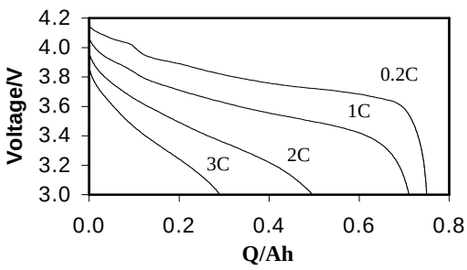


Fig. 2 Exploded preshaped battery inside the housing of a portable product

Fig 3. Rate capacity tests of a 750mAh preshaped Lithylene battery



[1] U.S. Patent Application Number: 09/352314