

RECENT NEW DESIGNS AND NEW TECHNOLOGIES OF LEAD/ACID BATTERIES IN JAPAN

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Introduction

Recent technical progress in lead/acid batteries in Japan is reviewed. Since the production and uses of such batteries depend on applications in automobiles, computers, and portable devices, production trends and new uses are discussed from the standpoint of these applications.

Technical trends in automotive batteries [1]

There are three types of present-day automotive batteries, namely: the conventional lead-antimony grid battery; the hybrid battery (lead-calcium grid for negative electrode and low-antimony grid for positive electrode); lead-calcium grid batteries. Changes in the technical trends and desired properties for automotive batteries since 1970 are shown in Table 1.

TABLE 1
Technical changes in automotive batteries from 1970 to 1990

	1970 - 1975	1980	1985 - 1990
Changes in automobiles	Effort to improve fuel consumption (change to I.C. regulator)	New trends in turbo-chargers and computerized systems	Need for higher reliability
Battery requirements	Smaller size of low-maintenance batteries	Maintenance free (sealed), capacity indicator	Longer life, high temperature operation
New technologies	High-performance battery — low resistance separator, thinner plate, low-antimony alloy	New calcium battery — calcium grid, expanded grid, envelope separator, etc.	Hybrid batteries — very low-antimony (1.7 wt. %) grid, sealed battery

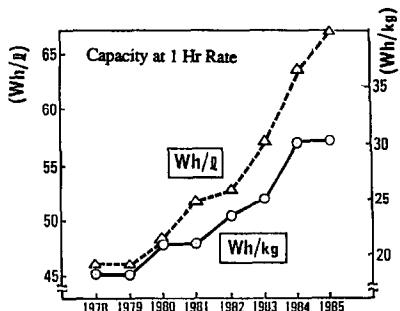


Fig. 1. Energy density of small, sealed lead/acid batteries.

Small, sealed lead/acid batteries [2]

These are being marketed and used for portable VTR and headphone stereo units. Improvements in energy density are shown in Fig. 1. The main design features are:

- use of electrolyte retainers (glass wool, etc.) with O_2 cycled gas-recombination mechanism
- good sealing with a reliable, re-sealable vent
- prevention of passive film formation by reducing the solubility of $PbSO_4$ upon deep discharge

Japan Storage Battery produces small, sealed lead/acid batteries.

α Pack PF Series

The special construction uses a very thin (0.08 mm) laminate film glued on a poly(propylene) frame to make a battery body. The entire body is inserted into a stainless steel case. There are four types of 2 - 6 V size (Table 2). These batteries have 30% greater energy density than Ni/Cd battery packs of the same size. The units are designed for portable devices such as CD players, headphone stereo units, and other communication devices.

TABLE 2
Specifications of α Pack sealed lead/acid batteries

Parameter	Battery type			
	PF2V0.45	PF4V0.5	PF4V0.75	PF6V0.45
Voltage (V)	2	4	4	6
Capacity (A h)	0.45	0.5	0.75	0.45
Weight (g)	33	70	111	110
Size (mm)	68 × 8 × 17.5	69 × 12.1 × 27.6	71.5 × 20 × 24.5	21 × 8 × 49.5

TABLE 3

Specifications of 'My Act' sealed lead/acid batteries

Type	V (V)	C/20 (A h)	Wt. (g)	Size (mm)	Energy density (W h kg ⁻¹)	Energy density (W h l ⁻¹)
My- Act	UP2V0.6	2	0.66	48	66.9 × 32.7 × 6.2	27.4
	UP2V1.0	2	1.02	68	96.3 × 32.7 × 6.2	29.9
	UP2V1.4	2	1.46	90	96.3 × 32.7 × 8.4	32.4
	UP2V1.8	2	1.88	115	96.3 × 41.4 × 8.4	32.7
CO*	LCR6V1.3	6	1.3	300	97.0 × 50.0 × 24.0	26.0
	LCR6V3.4	6	3.4	620	134.0 × 60.0 × 34.0	32.9

CO* = comparable previous products.

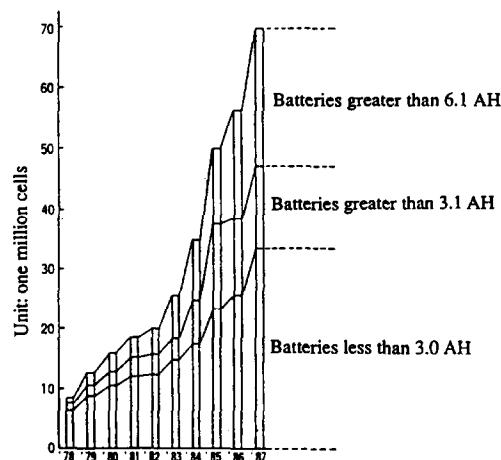
'My Act'

Details of this small, sealed lead/acid battery, developed by Matsushita Battery Company, are given in Table 3.

The Japanese market for small, sealed lead/acid batteries was 9351 million yen (\$74.8 million) in 1987 and is growing at a rate of about 15% per year. The main uses of the batteries are: portable video units 39%, communication 16%, home appliances 11%, office automation 11%, security devices 7%.

Large sealed lead/acid batteries (1000 - 3000 A h) [4]

A maintenance-free sealed battery (Type: MSE 3000) with a capacity of 3000 A h at the C/10 rate and 1950 A h at the C/10 rate has been commercially developed.



Average increase is 27% per year.

Fig. 2. Shipment of small, sealed lead/acid batteries in Japan.

Isotropic graphite addition to the positive electrode [5]

The beneficial action of added graphite powder has been reported for conventional lead/acid batteries. Recently, graphite additions (up to 1 wt.%) have been examined for retainer type sealed batteries. It was found that the effectiveness (increase in the discharge capacity) was greater at higher rates of discharge.

Production increase and new application areas for lead/acid batteries [6]

Figure 2 shows the production, size and capacities of recent batteries.

References

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