

Li-ion Battery Module for Small Electric Vehicles

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ABSTRACT

Li-ion Battery is superior in a characteristic with a high energy density and long cycle life. We try to use these good points and exchange lead acid battery for Li-ion on the small electric vehicles. We report on the development battery module for two kinds of different electric vehicles. As a result, we understand that Li-ion battery influenced the vehicles to be light-weight, and the life of the battery became long.

1. Introduction

The Li-ion battery has been developed as a power supply for a mobile-phone and a small video, notebook-sized personal computer since 1990. It has spread to the most mobile devices recently. A zero-emission design of the State of California atmosphere resources station was announced in the latter half of 1980's, and the development of a fuel cell and the battery car started the application to a movement body, and a car using a lead acid battery and the Ni-MH battery was produced experimentally then. The large-sized Li-ion battery has been developed recently. So, we experimented on the battery exchange to small electric vehicles using the large-sized Li-ion. We report this result.

2. Method

We try to battery exchange from lead acid battery to Li-ion battery on the small electric vehicle. Case-A is use for "COMVOY-88" by MITSUOKA-Motor Company. Case-B is use for "COMOS" by TOYOTA-Body Company. A lead acid battery is used both vehicles. Table 1, 2 shows battery exchange date. Figure 1 is a photo of batteries.

Li-ion cell specification is

Case-A

Cathode material is $\text{Li}(\text{Mn}/\text{Ni}/\text{Co})\text{O}_2$

Anode material is Carbon

Rated voltage is 3.6V

Rated capacity is 15AH

Weight is 530g

Dimensions 148x210x6.5mm

Energy density is 100Wh/kg

Case is can type

Case-B

Cathode material is LiMnO_2

Anode material is Carbon

Rated voltage is 3.7V

Rated capacity is 10AH

Weight is 270g

Dimensions 120x207x6.1mm

Energy density is 140Wh/kg

Case is laminating type

Table 1. Case-A "COMVOY-88" battery exchange date

COMVOY-88	Lead Acid	Li-ion
Battery	12V-70Ahx6S	21Sx4P
	72V-70AH	75V-60Ah
Vehicle Weight	236kg	
Battery Weight	129kg	56kg
50km/h run	43.5Ah(62%)	53.0Ah(88%)
	48km	68km
30km/h run	48.8Ah(70%)	58.0Ah(97%)
	67km	102km
Battery cycle life	1.5 years	4years over



Fig. 1 Photo of the Vehicle and Battery in case-A
Lead Acid type (L)/Li-ion type (R)

Table 2. Case-B "COMOS" battery exchange date

COMOS	Lead Acid	Li-ion
Battery	12V-60Ahx6S	21Sx4P
	72AV-60AH	75V-40Ah
Vehicle Weight	284kg	
Battery Weight	126kg	30kg
Battery Capacity	60Ah at 0.2C	40Ah at 0.2C
	43Ah at 1C	39Ah at 1C
Distance per change	50km	55-60km
Battery cycle life	1.5-2.0 years	6years



Fig.2 Lead acid battery in case-B

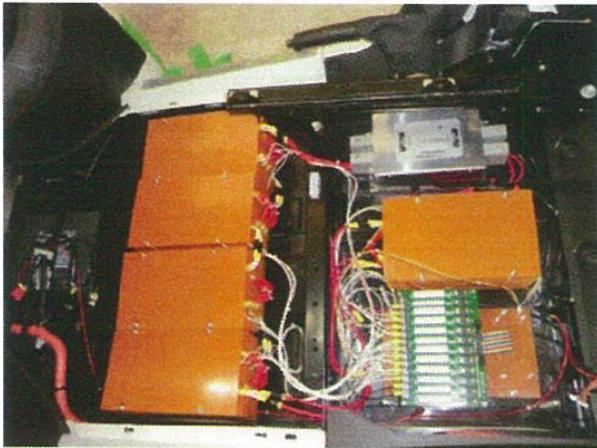


Fig.3 Li-ion battery in case-B



Fig.4 EV " COMS " with Li-ion Battery

3. Results and Discussion

Li-ion battery becomes 25V by 7 series. This voltage is same as two lead acid battery series. It is the same voltage that lead acid battery is 6 years and Li-ion battery is 21 series. The weight energy density of the Li-ion is 3 times of the Lead acid, and large weight loss is possible. In this experiment, light weighting from 70kg to 100kg was possible with small electric vehicles for single passenger.

References

[1] H.Matsuo Large sized Li-ion battery, Mar 2012