MONITORING OF CHANGES BATTERIES MASS AT FAST CHARGING NI-MH BATTERRIES

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ABSTRACT

In this time is not unambigouesly evidenced if the fast charge on Ni-MH batterries gives betterment on structute of electrods and prolongation of battery's life. The destination of this work is demonstrate the effect of standard and fast charge on Ni-MH batterries in practise.

1 PREFACE

In this time the rechargeable batteries represent main restrictive factor for expressive use of electric vehicles, mainly for their short range and high acquisition price. Their extension range is restricted firstly by using a new type of batteries as nickel and hybrid metal, Li-ion and zinc-air or zinc-silver. Second by using systems of fast charging that demeans time of charging from 6 and more hours to 2 hours and less.

2 TYPE OF ACUMULATORS FOR USING IN ELECTRIC VEHICLES

On the begining of project I´am decided using commercial Ni-MH accumulators from company SAFT, serie VH (Figure No. 1), atribution of single accumulator is VH D. This type of accumulator is normal accessible on European market and it is determinated for using in electric scooter, alectric bycycle and whealchair for handicapped people. Of course it has other using in a lot of mobile electricial equipments. Let say some of his pre-eminence:
relative big capacity, possibility fast and ultrafast charging, temperature range from 0 to 40 °C , good possibility of storing and so on.

3 ELECTRICAL PROPERTIES OF CELL

Rated voltage [V]	1,2
Typical capacity [mAh]	8500

Minimun capacity [mAh]	8000
IEC designation	HR 33/62
Impedance by 1 Khz [mΩ]	4
Standard charging current [mA]	850
Charging time [h]	16
Permanent discharging current by 20 °C [A]	40
Peak discharging current by 20 °C [A]	100
Teperatura range [°C]	0 – 40

Fig. 1: *Accumulators serie VH*

4 DIMENSIONS AND WEIGHT OF CELL

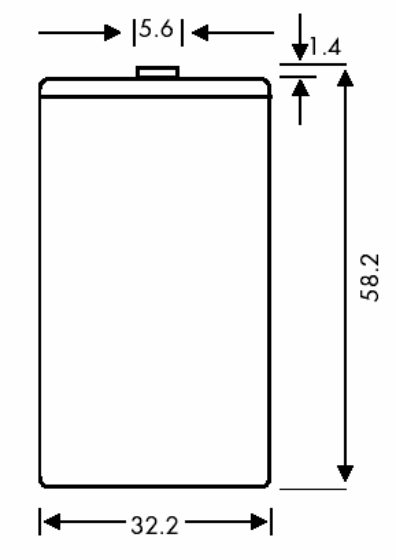

Fig. 2: *Dimensions of cell (mm)*

Weight [g]	160

5 THE FIRST USING BATTERIES AND CAPACITY TEST

For good functionality introduction accumulator cells to using its necessary to do formated. Most of avaibling cells are formated gy producer in advance. And Ni-MH accumulator from company SAFT type VH D is formated by producer. It folows that before the pre-production and folowing by measuring in practise is necessary do capacity test. Capacity test was done by the morm ČSN EN 61951-2. Capacity test is done as folows. The first i had to discharge the single cell to definitive voltage 1 V. After charging it was necessary to wait for 1 to 4 hours and then I had to do discharging 0,2 I_t for time 5 hours. Capacity test was done at 25 cells. Every cells was designation by the number.

5.1 THE WORK PLACE FOR DOING CAPACITY TEST

The work place is showed on the figure No. 3. There are chargers , dischargers, controlled by the computer with optimal software. Communication between computer and charges is runing on the seriál data comunication. Chargers are transfering data to the computer. Data contains values of temperature on the cells, current and voltage. Measure single quantity run in period of 15 seconds.

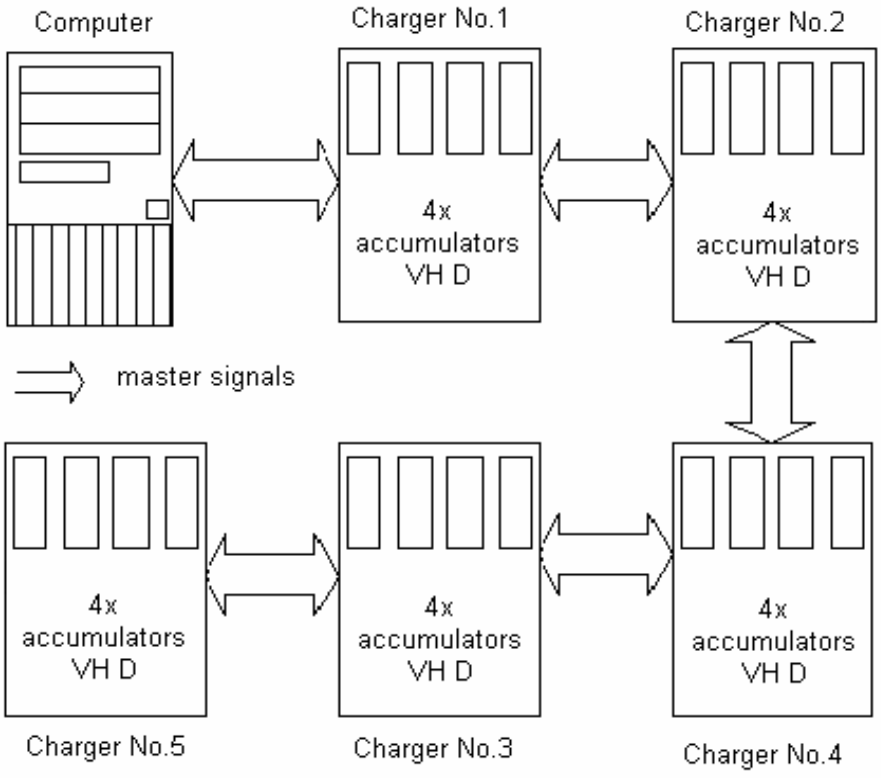

Fig. 3: *Block diagram – work place for capacity test*

5.2 CAPACITY OF SINGLE CELLS IN THE BEGINING OF USING

The cells are delivered by the producer they should have manufacture capacity. Capacity of single cell never be the same but capacity should not be down under specific stint. Production procedures are not able to reach coresponding capacity at all cells. Capacity was calculated by the software, which was delivered to chargers. Measured value of capacity after zeroth charging cycle single cells I show in the folowing table (Table No. 1) and figure No. 4.

Number of Cells	Capacity [Ah]	Number of Cells	Capacity [Ah]
1	7,875	14	8,182
2	7,70	15	7,956
3	7,877	16	7,926
4	8,065	17	7,919
5	8,027	18	7,855
6	8,196	19	7,862
7	8,230	20	7,670
8	8,007	21	8,213
9	7,798	22	8,051
10	8,109	23	7,928
11	7,559	24	8,022
12	8,211	25	8,134
13	7,762		

Tab. 1: *Measured value of capacity after zeroth charging cycle*

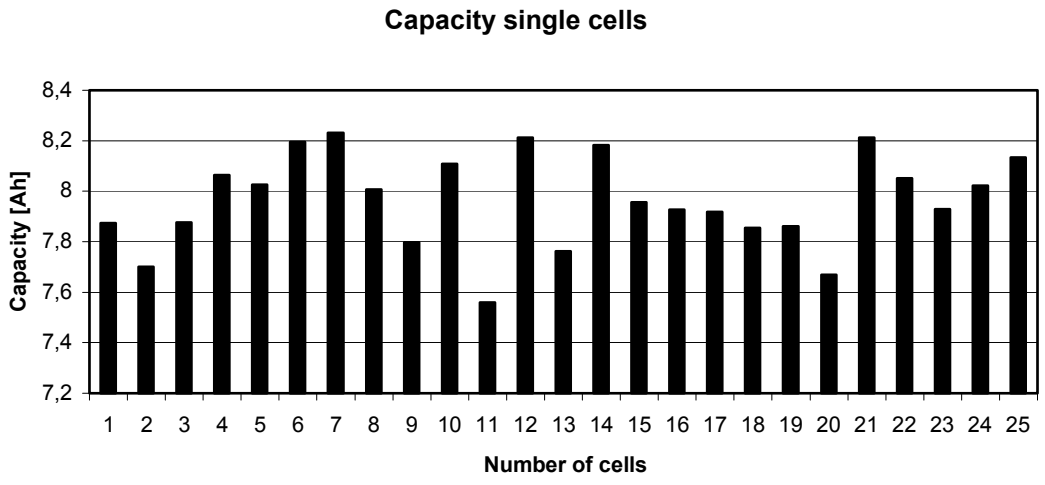

Fig. 4: *Diagram of capacity*

6 MICROSCOPY ENQUIRY

I unjointed the lowest cell number eleven (11). Before unjointing i had to discharge the cell on 0,3 V, not to take place short circuit and change structure of electrode. After removal metalic case of battery is necessary separate positiv and negative electrodes from separator. Every electrode I cut to 30 square with dimensions 1,5 x 1,5 cm. By doing sample we must be carefully to not touch the sample. After cutting is necessary to clean sample from electrolyte. The electrolyte is cleared by dipping to the destilled water for 24 hours. This procedure we must repeat twice. After this we must dry the sample, it takes about 12 hours. Then we put the sample to the PVC pocket and herewith we hinder from solvent enviroment on sample.

7 CONCLUSION

In the present time Ni-MH cells which are using as power source in electric vehicles, have lifetime obout 1000 cycles. After making basic measurement and after few cycles is not indemonstrable difference between standard and fast charging.

Not even microscopy observation structures of electrodes did not certify differnce between standard and fast charging.

But I´am supposing that differences will be show with excrescent number of cycles.

REFERENCES

[1] ČSN EN 60 285+A1 (36 4370) Alkalické akumulátorové články a baterie-Niklkadmiové válcové neprodyšně uzavřené akumulátorové články. Praha, Český normalizační institut, 1996.

[2] ČSN EN 61 436 (36 4377) Akumulátorové články a baterie obsahující alkalické nebo jiné nekyselé elektrolyty-Niklmetalhydridové uzavřené plynotěsné akumulátorové články. Praha, Český normalizační institut, 1999.

[3] ČSN EN 61 434 (36 4390) Akumulátorové články a baterie obsahující alkalický nebo jiný nekyselý-Pokyny pro značení proudu v normách pro alkalické akumulátorové články a baterie. Praha, Český normalizační institut, 1998.

[4] Saft, Romainville, France, Portable Ni-Cd and Ni-MH cells and batteries catalogue, 1999.

[5] Panasonic Industrial Europe GmbH, Hamburg, Germany, Nickel Cadmium Batteries Technical Handbook ‘98/’99, 1998.

[6] Bateria Slaný CZ s.r.o., Slaný, Bateria Plus Pro Vás.