Measurement of the Temperature Influence on NiMH Accumulator Characteristic

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Abstract. The work deals with influence of the temperature on cylindrical type nickel-metal hydride (further NiMH) accumulators. The basic aim of the research is to study charging and discharging characteristics of accumulator depending on the working temperature from 20 °C to 45 °C. According to the reached results it is effort to predict the capacity, lifetime and other parameters of battery during duty cycle especially in mobile devices such as robots, RC models, etc. The first measurement on the intelligent battery charger Robitronic Overloader2 has been performed and the special measurement card for data collection has been created.

1 Introduction

The sealed NiMH accumulators are one of the most used power supply and these days have become a mainstay in rechargeable accumulators. They have higher capacity (energy density) than nickel-cadmium ones and are more friendly to the environment that the other types because contain no cadmium, mercury or lead.

The main advantages of NiMH accumulators are:

- Up to 40 % higher capacity / energy density than the NiCd or Lead-acid ones
- High drain current, that means low internal resistance
- Compact size (flexible to user demand)
- Acceptable cost
- Contain no heavy metals

Due to this positive qualities NiMH are also commonly used, except mobile devices and robots, in all kinds of consumer electronics, multimedia devices, mobile phones, notebooks, etc.

Basic characteristics of NiMH in numbers are:

- Nominal voltage per one cell 1,2 V
- Voltage of fully charged cell 1,35 – 1,4 V (without load)
- Voltage of flat cell 1,1 – 1,0 V
- Energy density 70 Wh / kg (250 kJ / kg)
- Volumetric energy density 300 Wh / l (360 MJ / m³)
General NiMH cells consist of a positive electrode, made of nickel hydroxide as an active material, a negative electrode composed of hydrogen absorbing alloys, a separator between electrodes and an alkaline electrolyte. All this parts are composed to the metal case with sealing plate and nowadays equipped with safety vent. The charge and discharge reactions in NiMH are on the Fig. 1, construction of the cylindrical cell on the Fig. 2.

2 Charging and Discharging Characteristics

This text works with influence of temperature on charging and discharging characteristic of NiMH. Used sample of NiMH accumulator was LPR VTEC NiMH-battery. This battery is made of 6 cells and output voltages is 7.2 V, capacity 1400 mAh.

All characteristics are measured by Robitronic Overloader2, connected through RS-232 or USB interface to notebook with appropriate measuring software LogView ver.2.4.5.203. The Overloader2 is a performance computerized system, which is capable of charging, discharging, cycling and conditioning of battery types – NiCD, NiMH, Li-Pol, Lead-acid and Li-XX and other features (especially