STUDY OF THE CHARGE-DISCHARGE CHARACTERISTICS OF METAL-HYDRIDE ELECTRODE MATERIALS

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Introduction

Lately metal-hydrides are widely used as negative electrodes for chemical power sources, namely, Ni–MH batteries. The high cycle life is the substantial requirement for performance of MH electrodes [1-2]. Recently our group investigated electrode materials using computerized potentiostat PI-50, which allowed examination charge-dis-charge characteristics of MH electrode during 10-20 cycles [3]. However in practice there is necessity to study MH electrodes during many hundreds charge-discharge cycles.

Results and discussion

We constructed the PGStat-8 device, which is simple in use, portable and much cheaper than foreign analogues. This device serves for high-cycle charge-discharge testing of electrodes on eight independent electrochemical cells. Testing can be carried out in halvanostatic or potentiostatic regimes. Measured present values of current, tension and time are shown on the alphanumeric display of the device, and are graphically registered on the PC monitor (Fig.1).

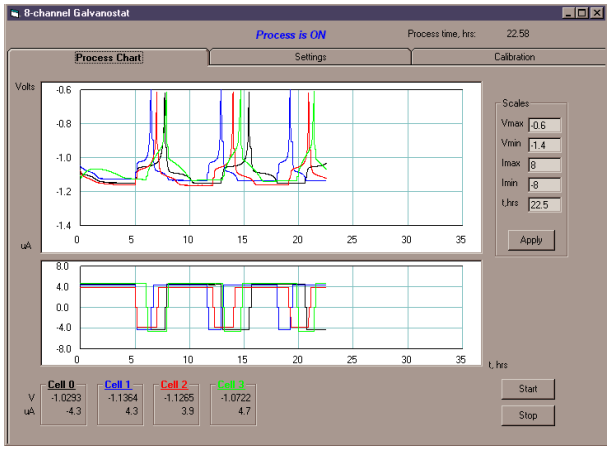

Fig.1. Window of graphical presentation of measured MH-electrode characteristics.

Using 128 kB built-in memory, the PGStat-8 device records data with 5–1000 s interval and the maximum working time without transfer of data to computer is ~ 4,5–900 h, respectively. All registered results are stored as data tables in the files with txt or xls extension.

MH electrode materials on the basis of REM, Mg and Ti were tested using this device. The value of discharge capacity was determined from discharge curves using the equation $C_d = (I \times \tau_p)/m$, where C_d – capacity of MH electrode; I – current; τ_p – discharge time; m – mass of metalhydride material. As an example, the C_d dependences on number of charge-discharge cycles are presented in Fig.2.

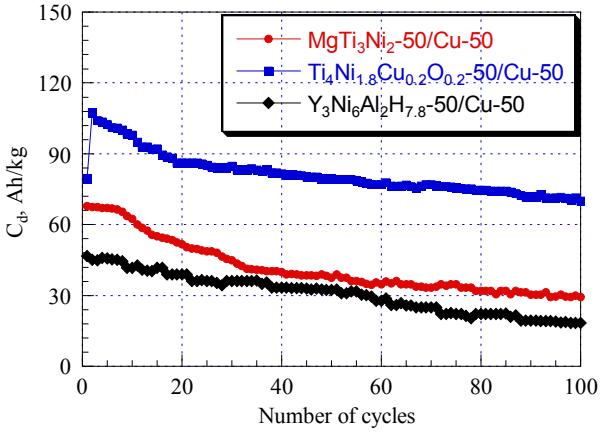

Fig.2. The capacity C_d vs the number of charge-discharge cycles for MH electrodes based on $MgTi_3Ni_2$, $Ti_4Ni_{1.8}Cu_{0.2}O_{0.2}$ and $Y_3Ni_6Al_2H_{7.8}$.

Conclusion

Constructed PGStat-8 device can be effectively used for determination of electrode material characteristics, which was demonstrated for different MH electrode materials in our studies.

References

1. Petrii O.A., Vasina S.Ya., Korobov I.I. Electrochemistry of hydride-forming intermetallic compounds and alloys. Usp. Khim. 1996; 65(3):195-210.
2. Cuevas F., Joubert J.-M., Latroche M., Percheron-Guegan A. Intermetallic compounds as negative electrodes of Ni/MH batteries. J. Appl. Phys. A. 2001;72:225-238.
3. Saldan I.V., Kovalchuk I.V., Zavaliy I.Yu. Influences of oxygen modification and alloying on the charge-discharge characteristics of metal-hydride electrodes based on Ti_2Ni. Physicochemical mechanics of materials (Ukr.) – Materials Science (Eng.) 2003;38(4):70-76.