

Karakteristik bahan anoda baterai NiMH (LaNi₅) setelah penambahan serium oksida (CeO₂) dan proses anil = Characteristic of anode materials laNi5 for (NiMH) battery after addition of cerium oxide (CeO₂) and annealing process / Ade Utami Hapsari

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Abstrak

ABSTRAK

Senyawa metal alloy (LaNi₅) biasa digunakan untuk anode baterai Nickel-Metal Hydride (NiMH) karena mampu mengabsorpsi hidrogen dan dapat beroperasi pada kondisi tekanan dan temperatur ruang. Ketika oksida logam tanah jarang ditambahkan ke dalam anode sel baterai NiMH, tidak hanya charge efficiency dan capacity-retention yang akan meningkat, tetapi juga menjadi rapid charge dan high power cycling. Penelitian dilakukan untuk melihat karakteristik bahan anode LaNi₅ setelah penambahan CeO₂ dan proses anil. Metode yang digunakan adalah mechanical alloying dengan mencampur serbuk LaNi₅ dengan serbuk CeO₂ sebanyak 1%, 2%, dan 3% berat di dalam ball mill selama 120 menit pada putaran 240 rpm. Setelah itu, dilakukan proses anil pada temperatur 300°C, 600°C, dan 900°C selama 6 jam di lingkungan gas argon. Kemudian, serbuk dikarakterisasi dengan menggunakan XRD, SEM-EDX, dan BET. Pengujian elektrokimia dilakukan dengan menggunakan Electrochemical Impedance Spectroscopy (EIS) pada frekuensi 5 mHz ? 100 kHz. Penambahan konsentrasi CeO₂ diatas 2%, akan memperkecil volume cell dan mengecilkan diameter pori. Konduktivitas tertinggi yang dicapai pada penelitian ini adalah sebesar 1.5332 S/cm dengan diameter pori 0.0082 cc/g. Walaupun penambahan konsentrasi CeO₂ ke dalam material anode meningkatkan tahanan material, tetapi penambahan 1% CeO₂ dapat meningkatkan ketahanan korosi material anode dengan Ecorr sebesar - 0.6432 V. Peningkatan temperatur anil menyebabkan perubahan difraksi fasa menjadi fasa NiO dan La₂O₃ yang menyebabkan konduktivitas menurun dan nilai tahanan semakin besar.

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ABSTRACT

A Lanthanum Nickel compound (LaNi₅) is widely used for an anode of Nickel-Metal Hydride (NiMH) battery due to excellence on hydrogen absorption and good capability to be operated at room temperature and pressure condition. Addition of rare earth oxide to the NiMH has increase charge-retention efficiency and capacity also has both rapid charge and high power cycling. The experiment has been conducted to observe the characteristic of the anode LaNi₅ materials after addition of CeO₂ and annealing. As method of this experiment, mechanical alloying was done by mixed LaNi₅ and CeO₂ powder which had 1%, 2% and 3%

weight mass in ball mill for 120 minutes at 240 rpm. After that, the annealing was carried out at varied temperature, 300°C, 600°C and 900°C for 6 hours in argon gas exposure. Then the powders were characterized with XRD, SEM-EDX, and BET. Electrochemical Impedance Spectroscopy (EIS) was used for electrochemical testing on the frequency between 5 mHz - 100 kHz. The results of this experiment show that increasing CeO₂ more than 2% concentration lead to decrease the volume of cells and the pore diameter. Furthermore, this is affect the value of ionic conductivity with the highest conductivity is 1.5332 S / cm and 0.0082 cc / g in diameter pore. Although the addition of CeO₂ concentration into the anode material increases the resistance, the addition of 1% CeO₂ can improve the corrosion resistance of the anode material with E_{corr} of -0.6432 V. In conclusions, annealing temperature increasing will changes diffraction phase with the dominant phase NiO and La₂O₃, thus the conductivity was decreasing and the resistance was increasing.