

P10**Positive plate morphology changes during cycle life testing of gelled-electrolyte VRLA batteries**

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Gelled-electrolyte valve-regulated lead–acid (VRLA) batteries have the advantage of low gassing and high performance in deep-cycle applications but during cycling the structure of the positive active material (PbO_2) changes, and this could limit cycle life.

This change in morphology of the positive active material during charge–discharge cycling with different charging currents has been observed in VRLA batteries. A charge–discharge cycling test has been carried out on two battery modules, each composed of six series-connected cells. The nominal capacity of the cells was 200 A/h at the C/10 rate.

The discharge current was the C/5 rate to 100% depth of discharge and the charging voltage was 2.4 V per cell, with the maximum current set at 40 or 20 A.

Every fifty cycles, one cell from each module was disassembled, to analyze the composition and morphology changes to the positive electrode using XRD and SEM. After 300 cycles, the changes in morphology of the positive active material were different, depending on the charging current and the location of the electrode. The sulfate, formed in the early stages of the cycling test, was converted to lead dioxide with cycling. The morphology of the active material under the higher charging current was observed to be well structured, and this could give rise to a longer cycle life.

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P11**A new lithium-ion battery system with a remarkably high capacity**

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Lithium-transition metal hydrides represented by the formula of $\text{Li}_{3-x}\text{M}_x\text{N}$ have been studied, particularly $\text{Li}_{2.6}\text{Co}_{0.4}\text{N}$, as active materials for negative electrodes in lithium-ion cells.

$\text{Li}_{2.6}\text{Co}_{0.4}\text{N}$ has a large reversible capacity of 700 mA h g^{-1} when compared with carbon as the active material for negative electrodes. On the other hand, lithium nickel oxide (LiNiO_2) also has a large reversible capacity of 180 mA h g^{-1} as a positive active material in comparison with LiCoO_2 when used in a conventional lithium-ion battery.

This new lithium-ion battery system, employing LiNO_2 and $\text{Li}_{2.6}\text{Co}_{0.4}\text{N}$, has a remarkably large capacity, owing to the multiplying effect of replacing both positive and negative electrodes with new, superior, types. This new system can provide double the capacity of the conventional carbon/ LiCoO_2 lithium-ion system.

This battery provides an average voltage of about 3.0 V, which is lower than that of the conventional type; however, the energy density is improved remarkably owing to the large capacity of the electrodes.

The electrochemical behaviour of $\text{Li}_{2.6}\text{Co}_{0.4}\text{N}$ as a negative electrode, and the behaviour of trial batteries have been evaluated. As a result, not only the larger capacity but also the superior rate performance and good cycling ability have been demonstrated.

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P12**Studies of nanocrystalline AB₂ alloys for nickel/metal hydride batteries**

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Due to the booming demand for mobile telephones and portable computers, intensive study is being conducted on nickel/metal hydride (Ni/MH) batteries, especially in order to reduce the weight of the alloys in the negative electrode. So, it would be extremely interesting to discover alloys with higher mass capacities, as this would mean batteries with better performances.

In the work presented here, we attempted to lighten an industrial alloy by partially substituting zirconium with magnesium. Magnesium was introduced in the AB₂ alloy