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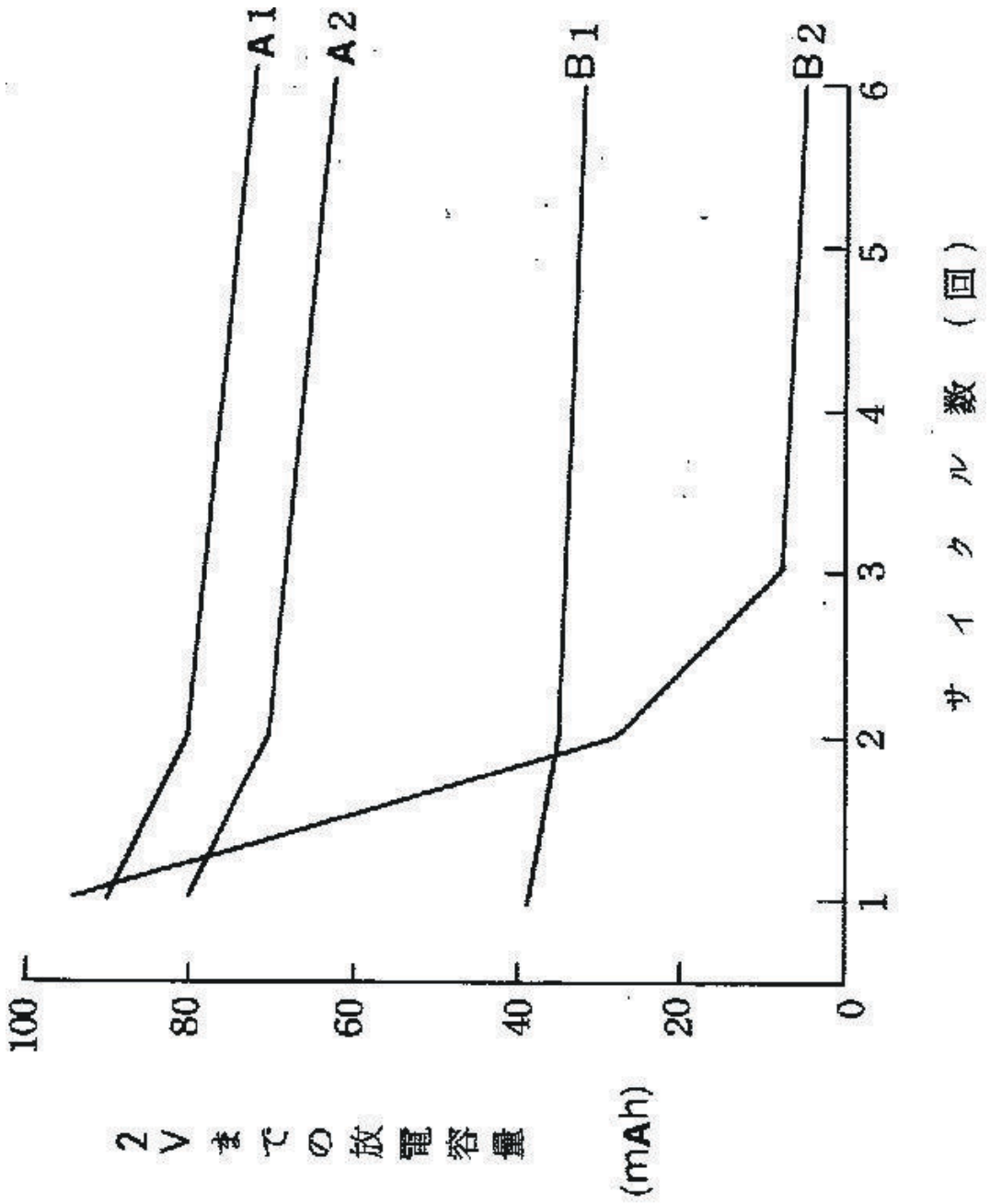
(71) [Applicant]
[Identification number] 000001889
[Name] SANYO Electric Co., Ltd.
(72) [Inventor]
[Name] Satoshi Ikukawa
(72) [Inventor] [
Name] Toru Amazutsumi
(72) [Inventor]
[Name] Keisaku Nakanishi
(74) [Agent]
[Patent Attorney]
[Name] Yasuhiro Toyosu

wrap up close —

(57) [Summary]
[Objective] To minimize the decrease in cycle life under normal use conditions and to minimize the decrease in discharge capacity due to overdischarge.
A non-aqueous electrolyte secondary battery includes a positive electrode mai nly composed of a rechargeable active material and a negative electrode cont aining lithium as an active material. In particular, in the secondary battery of the present invention, the theoretical capacity ratio between the positive elect rode and the negative electrode is set within the range of 1:1 to 1.3.
[Effect] By setting the theoretical capacity ratio between the positive electrod e and the negative electrode within an extremely limited range, during overdi scharge, the positive electrode is consumed and a large amount of the negati ve electrode active material remains, and the discharge reaction proceeds, ca using the electrolyte to decompose and conduct electricity. It is possible to eff ectively prevent deterioration of battery performance due to side reactions su ch as reactions between the agent and the negative electrode active material.



The scope of the claims open

[Scope of Claims]

[Claim 1] A non-aqueous electrolyte secondary battery comprising a positive

electrode mainly composed of a rechargeable active material and a negative electrode containing lithium as the active material, wherein the theoretical capacities of the positive electrode and the negative electrode
are A non-aqueous electrolyte secondary battery, characterized in that the ratio is designed to be in the range of 1:1 to 1.3.

detailed description open —

Description: BACKGROUND OF THE INVENTION

1.

Field of the Invention The present invention relates to a positive electrode mainly composed of a rechargeable active material such as manganese oxide, and a negative electrode composed of metallic lithium, lithium-aluminum alloy or the like. It relates to a non-aqueous electrolyte secondary battery.

2.

Description of the Related Art In a non-aqueous electrolyte secondary battery in which the positive electrode active material is manganese dioxide and the negative electrode is lithium, the following reaction occurs between the positive electrode and the negative electrode during charging and discharging.

Negative electrode during discharge: $Li \rightarrow Li^{+} + e^{-}$

Positive electrode during discharge: $MnO_2 + xLi^{+} + e^{-} \rightarrow Li_xMnO_2$

Negative electrode and positive electrode during charge: $Li_xMnO_2 \rightarrow xLi + MnO_2$

Li is eluted as Li^{+} ions, and when charged, the Li^{+} ions are deposited on the surface as metal Li. A non-aqueous electrolyte secondary battery that is charged and discharged by this reaction decreases the amount of lithium as it is charged and discharged. The reason for this is that lithium deposited on the surface of the negative electrode during charging gradually reacts with the electrolyte to form a negatively active product. That is, the following reactions proceed during charging and discharging.

[0004] ① In the charging process, Li^+ ions are converted into Li and deposited on the surface of the negative electrode. ② Part of the Li deposited on the surface of the negative electrode reacts with the solvent to form a chemically inactive reaction product. ③ During discharge, Li is eluted and becomes Li^+. However, in this step, not all Li deposited on the surface of the negative electrode is eluted. This is because an inert reaction product produced by the reaction of Li with the solvent becomes Li^+ and does not elute.

[0005] Therefore, ①all of the Li deposited on the negative electrode in the step (2) cannot be eluted as ③Li^+ ions in the step (3). Therefore, as charging and discharging progress, the amount of lithium that can be eluted from the negative electrode decreases, shortening the cycle life. In order to overcome this drawback, conventional non-aqueous electrolyte secondary batteries have a negative electrode capacity that is at least twice the positive electrode capacity.

[0006]

However, a non-aqueous electrolyte secondary battery in which the negative electrode capacity is at least twice the positive electrode capacity is discharged to 0 V, that is, when it is overdischarged, it cannot be recharged. The performance of the battery deteriorated such that it became impossible to discharge even when the battery was charged, and the capacity decreased significantly. It means that the negative electrode capacity is the positive electrodeIn a non-aqueous electrolyte secondary battery with a capacity of more than twice the capacity, when overdischarged to 0 V, the negative electrode active material and the negative electrode active material react, that is, even after the positive electrode capacity is exhausted. This is because the remaining substance promotes the discharge reaction, causing side reactions such as the decomposition of the electrolyte and the reaction between the conductive agent and the negative electrode active material, thereby deteriorating the battery performance.

[0007] The present invention was developed with the object of further solving this drawback. An object of the present invention is to provide a non-aqueous electrolyte secondary battery capable of extremely reducing the decrease in discharge capacity due to discharge.

[0008]

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