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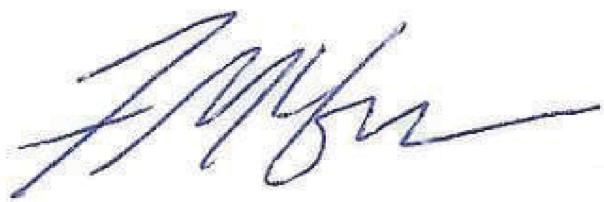

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(54) [Title of the Invention]

Non-Aqueous Electrolyte Secondary Battery

(57) [Abstract]

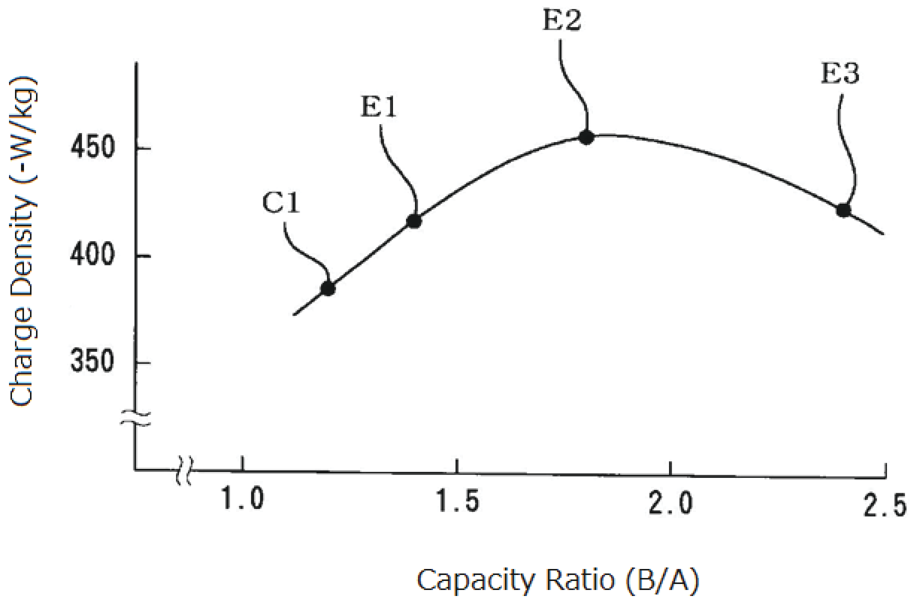
[Problem]

To provide a non-aqueous electrolyte secondary battery with better charging characteristics than the prior art.

[Solution]

A secondary battery consisting of a positive electrode, a negative electrode, and a nonaqueous electrolyte, wherein the capacity ratio (B/A) between the electrode capacity A of the positive electrode and the electrode capacity B of the negative electrode is 1.3 < (B/A) ≤ 2.5.

(Fig. 3)



[Claims]

[Claim 1]

A secondary battery comprising a positive electrode, a negative electrode, and a nonaqueous electrolyte, wherein the capacity ratio (B/A) between the electrode capacity A of the positive electrode and the electrode capacity B of the negative electrode is $1.3 < (B/A) \leq 2.5$.

[Detailed Description of the Invention]

[0001]

[Technical Field]

The present invention relates to a nonaqueous electrolyte secondary battery, such as a lithium secondary battery.

[0002]

[Prior Art]

With the trend in recent years toward cordless electronic devices and demand for the development of electric vehicles in response to environmental problems, there is growing demand for secondary batteries with a high energy density. Conventional secondary batteries include lithium secondary batteries, which are non-aqueous electrolyte secondary batteries. Conventional lithium secondary batteries consist of a positive electrode and negative electrode made of an active material that can absorb and release lithium, and a nonaqueous electrolyte.

[0003]

Lithium secondary batteries have been studied and developed with emphasis on discharge capacity and cycle characteristics. For example, in JP H09-293536 A, the ratio of the reversible capacities of the positive and negative electrodes (negative electrode/positive electrode) is 1.05 to 1.30 in order to ensure sufficient Li ion storage capacity in the negative electrode, and thus eliminate Li deposits and reduce cycle degradation.

[0004]

[Problem to Be Solved by the Invention]

As mentioned above, conventional nonaqueous electrolyte secondary batteries have been developed with an emphasis on improving discharge capacity and cycle characteristics. However, secondary batteries used in the most recent hybrid vehicles equipped with hybrid engines must have high charging characteristics as well as discharge characteristics. Although conventional nonaqueous electrolyte secondary batteries have been able to demonstrate excellent performance in terms of discharge capacity and cycle characteristics, their charging characteristics are still inadequate.

[0005]

It is an object of the present invention to solve this problem by providing a nonaqueous electrolyte secondary battery with better charging characteristics than the prior art.

[0006]

[Means for Solving the Problem]

The invention according to claim 1 is a secondary battery comprising a positive electrode, a negative electrode, and a nonaqueous electrolyte, wherein the capacity ratio (B/A) between the electrode capacity A of the positive electrode and the electrode capacity B of the negative electrode is $1.3 < (B/A) \leq 2.5$.

[0007]

If the capacity ratio (B/A) is less than 1.3, the improvement in charging characteristics is insufficient. Therefore, a value of 1.4 or higher is preferred. Meanwhile, if the capacity ratio (B/A) exceeds 2.5, the increase in the ratio of the negative electrode in a fixed volume battery container causes the absolute volume of the positive electrode to decrease in relative terms, resulting in a decrease in battery capacity and an increase in irreversible capacity, which in turn reduces the actual capacity that can be drawn upon.

[0008]

Examples of positive electrode active materials that can constitute the positive electrode include inorganic compounds such as metal oxides of alkali metals and metal chalcogens, as well as conductive polymers. Specific examples include Li-containing transition metal oxides such as Li_XMO_Y (where M includes at least one transition metal such as Co, Mn, Ni, V, and Fe), metal oxides such as V_2O_5, metal chalcogenides such as TiS_2, MoS_2, and $NbSe_3$, and conductive polymers such as polyaniline, polypyrrole, and polyacene.

[0009]

Examples of negative electrode active materials that can constitute the negative electrode include metals, carbonaceous materials, metal chalcogenides, metal oxides, and conductive polymers. Specific examples include metal Li, alloys of Li with other metals such as Al, Zn, and Sn, carbonaceous materials such as graphite and amorphous carbon, metal oxides such as Li_XMO_Y (where M includes at least one transition metal such as Ti, V, Mn, Co, and Fe), Nb_2O_5, and WO_3, metal chalcogenides such as TiS_2, MoS_2, and $NbSe_3$, and conductive polymers such as polyacene and polyacetylene doped with Li ions, etc.

[0010]

The action of the present invention will now be described. In the nonaqueous electrolyte secondary battery of the present invention, the capacity ratio (B/A) is limited to the specific range of $1.3 < (B/A) \leq 2.5$. As a result, the nonaqueous electrolyte secondary battery can obtain excellent charging characteristics, as described in detail in the examples below. The nonaqueous electrolyte secondary battery of the present invention can demonstrate excellent charge-discharge characteristics that are even adequate in hybrid vehicles equipped with a hybrid engine.

[0011]

[Embodiment of the Invention]

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