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## ***Patents ALERT***

This section contains abstracts of recently issued patents in the United States and published patent applications filed from over 100 countries under the Patent Cooperation Treaty and compiled in accordance with interest profiles developed by the editors.

***Journal of Power Sources***

*LEAD-ACID***6492059****SEPARATOR FOR SEALED LEAD-ACID BATTERY**

Takashi Hottori; Akihiro Taniguchi; Kazunari Ando; Japan assigned to Matsushita Electric Industrial Company Ltd.

A sealed lead-acid battery includes a separator made from hydrophilic treated sheet made from synthetic fiber which wraps at least either one positive electrode and a negative electrode. A mat type separator made from fine glass fiber is disposed between the wrapped electrode and its opposite electrode. This structure is adopted in a battery which uses a paste type electrode where an expanded grid having no outer frame on both edges is used, thereby prolonging cycle life even after cycling of charge and deep discharge.

**6495288**

**LEAD-ACID BATTERY HAVING TIN IN POSITIVE ACTIVE MATERIAL AND SILICA IN SEPARATOR**

Masaaki Shiomi; Yuichi Okada; Tadashi Shiroya; Japan assigned to Japan Storage Battery Company Ltd.

In a lead-acid battery, a positive active material includes tin in an amount of from not less than 0.2% to not more than 5% based on the weight thereof. The density of the positive active material after formation is from not less than 3.75 g/cm<sup>3</sup> to not more than 5.0 g/cm<sup>3</sup>. When the lead-acid battery is produced by a battery container formation, time required between the injection of an electrolyte and the beginning of battery container formation is from not less than 0.1 h to not more than 3 h.

**6495286**

**GLASS FIBER SEPARATORS FOR LEAD-ACID BATTERIES**

George C. Zguris; Frank C. Harmon Jr.; USA assigned to Hollingsworth and Vose Company

A glass fiber separator material is disclosed. The separator is composed of a mass of intermeshed glass fibers substantially all of which have a fiber diameter not greater than about 20 μm, and at least 5% (w/w) of which have a fiber diameter less than 1 μm, and distributed through the glass fibers, and from 0.2 to 20% (w/w) of cellulose fibrils. The fibrils are from a slurry having a Canadian freeness sufficiently low that the separator material has a tensile strength greater than an otherwise identical separator where glass fibers having an average diameter greater than 1 μm replace the cellulose fibrils.

*BATTERY MATERIALS***6491789**

**FIBRIL COMPOSITE ELECTRODE FOR ELECTROCHEMICAL CAPACITORS**

Chun-Ming Niu; USA assigned to Hyperion Catalysis International Inc.

Composite electrodes including carbon nanofibers (fibrils) and an electrochemically active material are provided for use in electrochemical capacitors. The fibril composite electrodes exhibit high conductivity, improved efficiency of active materials, high stability, easy processing, and increase the performance of the capacitor. A method for producing the composite electrodes for use in electrochemical capacitors is also provided.

**6491841**

**ELECTROLYTES FOR ELECTROCHEMICAL DOUBLE LAYER CAPACITORS**

Yuril Maletin; Natalie Strizhakova; Vladimir Izotov; Antonia Mironova; Valery Danilin; Sergey Kozachov; Ukraine assigned to Superfared Ltd.

Novel organic electrolytes comprising tetrafluoroborates and hexafluorophosphates of doubly charged cations of *N,N*-dialkyl-1,4-diazabicyclo[2,2,2]octanediium (DADACO) are disclosed, which have general formula, where R is the alkyl C1-C4, and Y31 is a BF<sub>4</sub><sup>-</sup> or PF<sub>6</sub><sup>-</sup> anion. The invention also comprises a process for the preparation of said electrolytes comprising at least one compound of formula and the use of compounds of formula dissolved in an aprotic polar solvent or a mixture of such solvents as an electrolyte for an electrochemical double layer capacitor.

**6493210**

**ELECTRODE METAL MATERIAL, CAPACITOR AND BATTERY FORMED OF THE MATERIAL AND METHOD OF PRODUCING THE MATERIAL AND THE CAPACITOR AND BATTERY**

Seiji Nonaka; Masakazu Tanahashi; Mikinari Shimada; Tamao Kojima; Munehiro Tabata; Japan assigned to Matsushita Electric Industrial Company Ltd.

The present invention relates to an electrode metal material for batteries, capacitors, etc., used in contact with non-aqueous electrolyte, and particularly to a capacitor formed of the electrode metal material, and provides a valve metal material capable of decreasing the internal resistance of the capacitor. The electrode metal material includes a valve metal material and numerous carbon particles included in the surface of the valve metal material. The carbon particles are further fixed in the surface of the valve metal material so as to expose to the surface. The electrode metal material is coated with an activated carbon layer and used as a double-layer electrode for an electric double-layer capacitor. The carbon particles included in the surface ensure conduction between the activated carbon layer and the valve metal material. With this configuration, even if the surface of the valve metal material is oxidized, the internal resistance of the electrode is not decreased, the internal resistance of the

capacitor is decreased, and the capacitance of the capacitor is increased.

**6493211**  
**ELECTROLYTE FOR ELECTROLYTIC**  
**CAPACITOR**

Takayuki Sugiyama; Masashi Ozawa; Hidehiko Itoh; Kenji Tamamitsu; Masao Sakakura; Japan assigned to Nippon Chemi-Con Corporation

An electrolyte having a high conductivity, an excellent high-temperature life characteristic and leading to improvement of the shelf characteristic of an aluminum electrolytic capacitor. At least one phosphate ion producing compound and a chelating agent are added using a solvent largely composed of water. Therefore, an aluminum electrolytic capacitor comprising such an electrolyte has a low impedance, an excellent high-temperature life characteristic, and an improved shelf characteristic.

**6495292**  
**WETTABLE NONWOVEN BATTERY**  
**SEPARATOR**

William W. Yen; USA

A nonwoven battery separator which comprises a nonwoven, the nonwoven formed from a plurality of fibers and at least one high solubility parameter polymer, which polymer forms an encapsulation sheath around the fibers. The encapsulation sheath optionally has pores of about 1  $\mu\text{m}$  or less and the separator is characterized in that it has a surface pore size of at least 5  $\mu\text{m}$ .

**6501640**  
**ELECTROCHEMICAL CAPACITOR**

Yusuke Niiori; Hiroyuki Katsukawa; Japan assigned to NGK Insulators Ltd.

An electrochemical capacitor is provided, including an organic electrolyte solution and polarized electrodes immersed in the organic electrolyte solution. As an active substance of the polarized electrodes, the reaction product of an electrochemical reaction of a partially oxidized carbon material that contains fine crystals of graphite-like carbon in an organic electrolyte solution is used. The electrochemical capacitor has a high electrostatic capacity density based on a pseudo-capacity.

*FUEL CELL*

**6497970**  
**CONTROLLED AIR INJECTION FOR**  
**A FUEL CELL SYSTEM**

Matthew H. Fronk; USA assigned to General Motors Corporation

A method and apparatus for injecting oxygen into a fuel cell reformat stream to reduce the level of carbon monox-

ide while preserving the level of hydrogen in a fuel cell system.

**6497971**  
**METHOD AND APPARATUS FOR IMPROVED**  
**DELIVERY OF INPUT REACTANTS TO A FUEL**  
**CELL ASSEMBLY**

Carl A. Reiser; USA assigned to UTC Fuel Cells, LLC

Disclosed is a fuel cell stack assembly for use in a fuel cell power plant and for producing electricity from fuel and oxidizer reactants. The fuel cell stack assembly includes a plurality of individual fuel cells each having an electrolytic medium, a cathode and an anode, and the cell stack assembly is adapted for defining anode flow fields for exposing the anodes to a fuel, cathode flow fields for exposing the cathodes to an oxidant. Also included are input and output manifolds defining input and output inner volumes in fluid communication with the cathode flow fields, and at least one blower mounted with one of the manifolds for flowing oxidizer through cathode flow fields. The blower can be mounted within an inner volume defined by a manifold, and can be a vane axial or centrifugal blower, and can be driven by a variable speed motor. Multiple blowers can be associated with the cell stack assembly, and can either push or pull (or both) the oxidizer through the cathode flow fields. In a fuel cell stack assembly having fuel cells arranged in separate stacks, each stack has a blower associated therewith.

**6497972**  
**FUEL CELL SYSTEM AND METHOD**  
**FOR CONTROLLING OPERATING**  
**PRESSURE THEREOF**

Yasukazu Iwasaki; Japan assigned to Nissan Motor Company Ltd.

A fuel cell system is provided with a water tank, a reformer obtaining reformed gas by reforming a fuel using water from the water tank, and a condenser reclaiming water from the exhaust gas from the condenser and return the water to the water tank. A method for controlling operating pressure is applied to such a fuel cell system. Here, in response to the exhaust temperature of the condenser, the equilibrium operating pressure of the fuel cell system at which the water inflow and outflow in the fuel cell system are balanced is calculated, and the maximum efficiency operating pressure at which the operating efficiency of the fuel cell system is maximum is calculated. Control is performed of the operating pressure of the fuel cell system so that it is the higher pressure of the equilibrium operating pressure and the maximum efficiency operating pressure.

**6497974**  
**FUEL CELL POWER SYSTEM, METHOD OF**  
**DISTRIBUTING POWER, AND METHOD OF**  
**OPERATING A FUEL CELL POWER SYSTEM**

William A. Fuglevand; USA assigned to Avista Laboratories Inc.

A fuel cell power system, comprising a fuel cell which generates d.c. voltage while operating; an ultracapacitor which, in operation, is electrically coupled with a load and has a voltage condition; and a circuit which, in operation, electrically couples and decouples the fuel cell to the ultracapacitor based upon the voltage condition of the ultracapacitor.

**6497975**

**DIRECT METHANOL FUEL CELL INCLUDING INTEGRATED FLOW FIELD AND METHOD OF FABRICATION**

Joseph W. Bostaph; Chowdary R. Koripella; Allison M. Fisher; Jay K. Neutzler; USA assigned to Motorola Inc.

A fuel cell device and method of forming the fuel cell device including a base portion, formed of a singular body, and having a major surface. At least one fuel cell membrane electrode assembly is formed on the major surface of the base portion. A fluid supply channel including a mixing chamber is defined in the base portion and communicating with the fuel cell membrane electrode assembly for supplying a fuel-bearing fluid to the membrane electrode assembly. An exhaust channel is defined in the base portion and communicating with the membrane electrode. A multi-dimensional fuel flow field is defined in the multi-layer base portion and in communication with the fluid supply channel, the membrane electrode assembly and the exhaust channel.

**6498121**

**PLATINUM-RUTHENIUM-PALLADIUM ALLOYS FOR USE AS A FUEL CELL CATALYST**

Alexander Gorer; USA assigned to Symyx Technologies Inc.

A noble metal alloy composition for a fuel cell catalyst, a ternary alloy composition containing platinum, ruthenium and palladium. The alloy shows increased activity as compared to well-known catalysts.

**6500319**

**PROTON EXCHANGE MEMBRANE (PEM) ELECTROCHEMICAL CELL HAVING AN INTEGRAL, ELECTRICALLY-CONDUCTIVE, COMPRESSION PAD**

Anthony B. LaConti; William A. Titterington; Larry L. Swette; Ricardo Leon; USA assigned to Giner Electrochemical Systems, LLC

Electrochemical cell comprises, in one embodiment, a proton exchange membrane (PEM), an anode positioned along one face of the PEM, and a cathode positioned along the other face of the PEM. To enhance electrolysis, platinum catalysts are present between the anode and the PEM and between the cathode and the PEM. A multi-layer metal screen

for defining a first fluid cavity is placed in contact with the outer face of the anode, and an electrically-conductive, spring-like, porous pad for defining a second fluid cavity is placed in contact with the outer face of the cathode. The porous pad comprises a mat of carbon fibers having a density of about 0.2–0.55 g/cm<sup>3</sup>. Cell frames are placed in peripheral contact with the metal screen and the compression pad for peripherally containing fluids present therewith. Electrically-conductive separators are placed in contact with the metal screen and the compression pad for axially containing fluids present therewith. A plurality of the cells may be arranged in series in a bipolar configuration, without requiring a separate compression pad between cells (for differential pressures up to about 400 psi).

**6500571**

**ENZYMATIC FUEL CELL**

Michael James Liberatore; Leszek Hozer; Attigana Narayanaswamy Sreeram; Rajan Kumar; Chetna Bindra; Zhonghui Hugh Fan; USA assigned to PowerZyme Inc.

Provided is a fuel cell comprising a first compartment, a second compartment and a barrier separating the first and second compartments, wherein the barrier comprises a proton transporting moiety.

**6500572**

**METHOD FOR OPERATING FUEL CELLS ON IMPURE FUELS**

Shanna D. Knights; Michael V. Lauritzen; Rajeev Vohra; David P. Wilkinson; Canada assigned to Ballard Power Systems Inc.

The electrocatalysts in certain fuel cell systems can be poisoned by impurities in the fuel stream directed to the fuel cell anodes. Introducing a variable concentration of oxygen into the impure fuel stream supplied to the fuel cells can reduce or prevent poisoning without excessive use of oxygen. The variation may be controlled based on the voltage of a carbon monoxide sensitive sensor cell incorporated in the system. Further, the variation in oxygen concentration may be periodic or pulsed. A variable air bleed method is particularly suitable for use in solid polymer fuel cell system operating on fuel streams containing carbon monoxide.

**6500573**

**HUMIDIFIER DEVICE FOR FUEL CELLS AND OPERATING SYSTEM THEREOF**

Takashi Simazu; Hiroshi Aoki; Tomohisa Wakasugi; Takahiko Asaoka; Kazutaka Hiroshima; Yutaka Ohya; Katsuhito Yamada; Japan assigned to Kabushiki Kaisha Toyota Chuo Kenkyusho

A humidifier device for use in fuel cells comprising a mist humidifier unit for adding mists to process gas supplied to an electrolyte equipped in a fuel cell and a humidifier unit control device for intermittently operating the mist humidifier unit in accordance with operating condition of the fuel cell.

**6500574****METHOD AND APPARATUS FOR A FUEL CELL  
BASED FUEL SENSOR**

Kevin R. Keegan; USA assigned to Delphi Technologies Inc.

Fuel concentrations are determinable in a solid oxide fuel cell through voltage measurement of one or more fuel cell units, where voltage is a function of hydrogen gas present in the fuel feed stream to the one or more fuel cell units. The voltage in the one or more fuel cell units is proportionally related to the fuel concentration in the fuel feed stream to the entire fuel cell. A sensor determines concentrations of the fuel flowing in the fuel cell. The sensor comprises a fuel cell unit, and an indicator electrically coupled to the fuel cell unit, the indicator being capable of displaying a voltage or being adapted to convert a voltage to a fuel concentration display. The voltage measured is correlated to the fuel concentration flowing in the fuel cell.

**6500578****STACKING AND MANIFOLDING OF ANGULARLY  
OFFSET, UNITIZED  
SOLID OXIDE FUEL CELLS**

Estela Ong; Nguyen Minh; USA assigned to Hybrid Power Generation Systems, LLC

A fuel cell stack comprises a plurality of planar fuel cells in a spiral configuration. The fuel cells angularly offset from one another such that immediately adjacent cells only partially overlap one another. The cells are preferably of the unitized type. A manifold assembly is operatively adjacent to the fuel cells. The manifold assembly includes an inlet manifold and an outlet manifold for each of the gases that are in communication with the fuel cells.

**6500579****FUEL CELL STRUCTURE**

Hideo Maeda; Hisatoshi Fukumoto; Kouji Hamano; Kenro Mituda; Japan assigned to Mitsubishi Denki Kabushiki Kaisha

A fuel cell including a unit cell and a separator panel alternatively stacked on one another. The unit cell includes an electrolyte membrane sandwiched between a fuel electrode and an oxidant electrode. The separator panel includes parallel fuel flow paths extending from a fluid supply port to a fluid discharge port for supplying fluid fuel to the fuel electrode and parallel oxidant flow paths extending from a fluid supply port to a fluid discharge port for supplying oxidant fluid to the oxidant electrode. At least the oxidant flow paths include groups of parallel flow paths, which extend back and forth within the divided regions of the main surface of the separator panel. The oxidant flow paths may include groups of parallel flow paths, positions along the groups of the parallel flow paths at equal distance from the respective fluid supply port being distributed substantially evenly over the main surface of the separator panel. Also, groups of parallel flow paths extend back and forth within a region defined by a

projection of the divided regions through which the oxidant flow paths extend. The ridge width of ridges defined between grooves within the parallel flow path group is smaller than the ridge width of the ridges defined between the grooves of the parallel flow path group adjacent to each other.

**6500580****FUEL CELL FLUID FLOW PLATE FOR  
PROMOTING FLUID SERVICE**

Russel H. Marvin; Charles M. Carlstrom Jr.; USA assigned to Plug Power Inc.

A fluid flow plate for a fuel cell includes a first face and a fluid manifold opening for receiving a fluid and at least one flow channel defined within the first face for distributing a reactant in the fuel cell. A dive through hole is defined in and extends through the fluid flow plate. The dive through hole is fluidly connected to the fluid manifold opening by an inlet channel, defined within an opposite face of the plate. The dive through hole and the inlet channel facilitate transmission of a portion of the fluid to the flow channel. A groove, adapted to receive a sealing member, is also defined within the first face and/or the opposite face. The sealing member may comprise a gasket which seals the respective fluid manifolds, thereby preventing leaking of fluid.

*LITHIUM BATTERIES***6488720****ANODE MATERIAL FOR NON-AQUEOUS  
LITHIUM SECONDARY BATTERIES, A METHOD  
FOR THE PRODUCTION THEREOF, AND  
BATTERIES USING SUCH ANODE MATERIALS**

Hitoshi Sakamoto; Koichi Kanno; Yuzuru Takahashi; Japan assigned to Mitsubishi Gas Chemical Company Inc.

A carbonaceous material for use as an anode material in secondary batteries using non-aqueous solvent comprises a material obtained by calcining a solid, the solid, in turn, being obtained by heating tar and/or pitch with furfural in the presence of an acid catalyst, the use of the resulting anode material imparting to the battery a relatively large capacity while having only a small irreversible capacity loss in the first cycle.

**6489055****LITHIUM SECONDARY BATTERY**

Akira Ichihashi; Ryuji Ohshita; Shin Fujitani; Japan assigned to Sanyo Electric Company Ltd.

In a lithium secondary battery provided with a positive electrode capable of intercalating and eliminating lithium ions, a negative electrode capable of intercalating and eliminating lithium ions, and an electrolyte, at least one of an imide group lithium salt represented by  $\text{LiN}(\text{C}_m\text{F}_{2m} + 1\text{SO}_2)(\text{C}_n\text{F}_{2n} + 1\text{SO}_2)$  (wherein  $m$  and  $n$  each

denote an integer from 1 to 4 and may be the same or different from each other) and a methide group lithium salt represented by  $\text{LiC}(\text{C}_p\text{F}_{2p} + 1\text{SO}_2)(\text{C}_q\text{F}_{2q} + 1\text{SO}_2)(\text{C}_r\text{F}_{2r} + 1\text{SO}_2)$  (wherein  $p$ ,  $q$  and  $r$  each denote an integer from 1 to 4 and may be the same or different from each other) is contained as a chief component of a solute in the electrolyte, and one of or both of a fluoride and a phosphorus compound are added to the electrolyte.

6489057

**POSITIVE ELECTRODE-ACTIVE MATERIAL  
AND LITHIUM CELL COMPRISING  
THE SAME**

Masayuki Yamada; Shigeo Aoyama; Japan assigned to Hitachi Maxell Ltd.

A copper–boron double oxide of the formula:  $\text{Cu}_j\text{M}_k\text{B}_m\text{O}_n$  in which M is a metal atom, and  $j$ ,  $k$ ,  $m$  and  $n$  are each a positive integer, a copper–molybdenum double oxide of the formula:  $\text{Cu}_x\text{Mo}_y\text{O}_z$  in which  $x$ ,  $y$  and  $z$  are each a positive integer, or a copper double oxide of the formula:  $\text{CuM}'_2\text{O}_4$  in which M' is at least one element selected from the group consisting of B, Al, Ga, Mn, Co, Ni and a rare earth element is useful as a positive electrode-active material of a lithium secondary cell.

6489060

**RECHARGEABLE SPINEL LITHIUM BATTERIES  
WITH GREATLY IMPROVED ELEVATED  
TEMPERATURE CYCLE LIFE**

Meijie Zhang; Yu Wang; Jan Naess Reimers; Michael Gee; Canada assigned to E-One Moli Energy (Canada) Limited

The loss in delivered capacity (capacity fade) after cycling non-aqueous rechargeable lithium manganese oxide batteries at elevated temperatures can be greatly reduced by depositing a small amount of certain foreign metal species on the surface of spinel in the cathode. In particular, the foreign metal species are from compounds having either bismuth, lead, lanthanum, barium, zirconium, yttrium, strontium, zinc or magnesium. The foreign metal species are introduced to the surface of spinel by moderately heating either an aqueous treated mixture or a dry mixture of ready-made spinel and the foreign metal compound.

6489063

**ADDITIVES FOR IMPROVING THE  
REVERSIBILITY OF A CARBON ELECTRODE  
OF A LITHIUM ION SECONDARY  
ELECTROCHEMICAL GENERATOR**

Denis Billaud; Abdelaziz Naji; Patrick Willmann; France assigned to Centre National d'Etudes Spatiales

The invention relates to additives to improve the reversibility of a carbon electrode of a lithium ion secondary electrochemical generator. These additives are composed of

cyclic or non-cyclic  $\alpha$ -halogenated esters such as  $\alpha$ -bromo- $\gamma$ -butyrolactone or methyl chloroformate. They may be added to the electrolyte at a rate of 0.5–3% by volume or adsorbed on the carbon electrode to form a passivation film on said electrode during the first use of the generator.

6489064

**ELECTROLYTE SYSTEM FOR LITHIUM  
BATTERIES, THE USE THEREOF, AND METHOD  
FOR ENHANCING THE SAFETY  
OF LITHIUM BATTERIES**

Wolfgang Appel; Sergej Pasenok; Juergen Besenhard; Lars Henning Lie; Martin Winter; Germany assigned to Solvay Fluor und Derivate GmbH

Electrolyte systems for lithium batteries with enhanced safety containing at least one lithium-containing conductive salt and at least one electrolyte liquid, in which the electrolyte liquid includes an effective amount of at least one partially fluorinated amide of formula (I) in which R1 is a linear C1–C6 alkyl group, or a branched C3–C6 alkyl group, in which one or more hydrogen atoms are replaced by fluorine atoms; or a C3–C7 cycloalkyl group optionally substituted one or more times by a linear C1–C6 alkyl group and/or branched C3–C6 alkyl group, in which one or more hydrogen atoms of are replaced by fluorine atoms; and R2 and R3 independently represent an identical or different linear C1–C6 alkyl group, a branched C3–C6 alkyl group or a C3–C7 cycloalkyl group, or R2 and R3 together with the amide nitrogen form a saturated five or six-member nitrogen-containing ring.

6492063

**LITHIUM SECONDARY BATTERY**

Hiroaki Ikeda; Masahisa Fujimoto; Shin Fujitani; Takuya Hashimoto; Yasuhiko Itoh; Ikuo Yonezu; Japan assigned to Sanyo Electric Company Ltd.

In a lithium secondary battery of this invention, the negative electrode uses, as an active material, an alloy including an A phase of a first intermetallic compound (A), and a B phase of a second intermetallic compound (B) having the same constituent elements as and a different composition from the first intermetallic compound (A) and/or a C phase consisting of one of the constituent elements of the first intermetallic compound (A), and at least one of the A, B and C phases is capable of electrochemically absorbing and discharging lithium ions. Thus, the lithium secondary battery can exhibit good charge–discharge cycle performance.

6492064

**ORGANIC SOLVENTS, ELECTROLYTES, AND  
LITHIUM ION CELLS WITH GOOD LOW  
TEMPERATURE PERFORMANCE**

Marshall C. Smart; Ratnakumar V. Bugga; Subbarao Surampudi; Chen-Kuo Huang; USA assigned to California Institute of Technology

Multi-component organic solvent systems, electrolytes and electrochemical cells characterized by good low temperature performance are provided. In one embodiment, an improved organic solvent system contains a ternary mixture of ethylene carbonate, dimethyl carbonate and diethyl carbonate. In other embodiments, quaternary systems include a fourth component, i.e. an aliphatic ester, an asymmetric alkyl carbonate or a compound of the formula  $\text{LiOX}$ , where X is R, COOR, or COR, where R is alkyl or fluoroalkyl. Electrolytes based on such organic solvent systems are also provided and contain therein a lithium salt of high ionic mobility, such as  $\text{LiPF}_6$ . Reversible electrochemical cells, particularly lithium ion cells, are constructed with the improved electrolytes, and preferably include a carbonaceous anode, an insertion type cathode, and an electrolyte interspersed therein.

**6495285**

**PHOSPHONATE ADDITIVES FOR NONAQUEOUS ELECTROLYTE IN RECHARGEABLE ELECTROCHEMICAL CELLS**

Hong Gan; Esther S. Takeuchi; USA assigned to Wilson Greatbatch Ltd.

A lithium ion electrochemical cell having high charge/discharge capacity, long cycle life and exhibiting a reduced first cycle irreversible capacity, is described. The stated benefits are realized by the addition of at least one phosphonate additive having the formula  $(\text{R1O})\text{P}(-\text{O})(\text{OR2})(\text{R3})$  provided in the electrolyte. In the phosphonate formula, R3 is a hydrogen atom and wherein at least one, but not both, of R1 and R2 is a hydrogen atom and the other of R1 and R2 is an organic group containing 1–13 carbon atoms. Or, at least one of R1 and R2 is an organic group containing at least three carbon atoms and having an  $\text{sp}$  or  $\text{sp}^2$  hybridized carbon atom bonded to an  $\text{sp}^3$  hybridized carbon atom bonded to the oxygen atom bonded to the phosphorous atom, or at least one of R1 and R2 is an unsaturated inorganic group.

**6495289**

**LITHIUM SECONDARY CELL WITH AN ALLOYED METALLIC POWDER CONTAINING ELECTRODE**

Soichiro Kawakami; Shinya Mishina; Naoya Kobayashi; Masaya Asao; Japan assigned to Canon Kabushiki Kaisha

In lithium secondary cells, alkali secondary cells and bromine-zinc secondary batteries capable of retarding the growth of a dendrite, which would occur at the time of charging thereof and result in performance degradation, and having high energy densities and long cycle lives, a method for forming a material of a negative electrode of such a secondary cell or battery and a method for handling the material of the negative electrode are provided. The

secondary cell or battery is provided with positive and negative electrodes separated from each other by a separator in an electrolyte contained in a case. The negative electrode is made of metallic powder alloyed with at least an amphoteric metal which reacts with both of an acid and an alkali.

**6495293**

**NON-AQUEOUS ELECTROLYTE COMPRISING A FLUORINATED SOLVENT**

Juichi Arai; Hideaki Katayama; Mitsuru Kobayashi; Japan assigned to Hitachi Ltd.

An organic electrolyte and polymer is provided wherein diffusivity of mobile ions is enhanced; and a lithium primary battery, lithium secondary battery, polymer secondary battery, and electrochemical capacitor, is provided which have increased capacities at a low temperature. A non-aqueous electrolyte and polymer electrolyte, wherein a fluorinated solvent having a fluorinated alkyl group, of which the terminal end structure is an unsymmetrical structure is mixed with the electrolyte and is provided for use in various applications.

**6497980**

**ORGANIC ELECTROLYTIC SOLUTION AND LITHIUM SECONDARY BATTERY ADOPTING THE SAME**

Duck-Chul Hwang; Ki-Ho Kim; Byung-Hyun Kang; Jea-Woan Lee; Yong-Beom Lee; Se-Jong Han; In-Sung Lee; South Korea assigned to Samsung SDI Company Ltd.

An organic electrolytic solution and a lithium secondary battery employing the same are provided. The organic electrolytic solution contains an organic solvent and a lithium salt and the organic solvent includes 20–60% by volume of ethylene carbonate, 20–70% by volume of dialkyl carbonate and 5–30% by volume of a fluorinated toluene compound. The organic electrolytic solution has improved high-temperature exposure characteristic by virtue of the use of a fluorinated toluene compound having a high boiling point in combination with mixed solvents of ethylene carbonate and dialkyl carbonate. The lithium secondary battery employing the organic electrolytic solution is excellent in the high-temperature exposure characteristic, while maintaining good discharge capacity and lifetime characteristics.

*NICKEL METAL HYDRIDE BATTERIES*

**6500583**

**ELECTROCHEMICAL HYDROGEN STORAGE ALLOYS FOR NICKEL METAL HYDRIDE BATTERIES, FUEL CELLS AND METHODS OF MANUFACTURING SAME**

Jason Ting; Ulrike Habel; Michael W. Peretti; William B. Eisen; Rosa Young; Benjamin Chao; Baoquan Huang; USA assigned to Energy Conversion Devices Inc., Crucible Materials Corporation

Practice of this invention provides, at least, a method of making a hydrogen storage material comprising the steps of: (a) forming a molten mixture comprising nickel and at least one other transition metal element, the combination of which will form a TiNi alloy and including in said molten mixture from about 0.1 at.% to about 10 at.% of one or more elements which will form an alloy which is immiscible in the TiNi-type alloy; and (b) cooling said molten mixture to form a solid alloy system material by rapid solidification of said molten mixture at a cooling rate of at least 103 °C/s.

**6489059**

**ALKALINE STORAGE BATTERY AND POSITIVE ELECTRODE USED FOR THE ALKALINE STORAGE BATTERY**

Tatsuhiko Suzuki; Yoshitaka Dansui; Hideki Kasahara; Kohji Yuasa; Japan assigned to Matsushita Electric Industrial Company Ltd.

An alkaline storage battery using positive electrodes comprising an active material containing nickel hydroxide particles and a rare earth element or a compound thereof containing or mixed with 0.1–100 ppm of Fe or an Fe compound based on the rare earth element or the compound thereof is provided.

**6492062**

**PRIMARY ALKALINE BATTERY INCLUDING NICKEL OXYHYDROXIDE**

Francis Wang; Enoch Wang; Philip Trainer; Guang Wei; USA assigned to The Gillette Company

An alkaline battery has a cathode including a nickel oxyhydroxide.

*COMPONENTS AND/OR CHARGERS*

**6489061**

**SECONDARY NON-AQUEOUS ELECTROCHEMICAL CELL CONFIGURED TO IMPROVE OVERCHARGE AND OVERDISCHARGE ACCEPTANCE ABILITY**

Sohrab Hossain; USA assigned to Litech, LLC

The present invention provides a secondary electrochemical cell comprising a body of aprotic, non-aqueous electrolyte, first and second electrodes in effective electrochemical contact with the electrolyte, the first electrode comprising active materials such as a lithiated intercalation compound serving as the positive electrode or cathode and the second electrode comprising a carbon material on carbon-based substrate and serving as the negative electrode or anode; whereby they provide a secondary non-aqueous electrochemical cell having improved overdischarge and overcharge acceptance ability

as compared with similar secondary non-aqueous electrochemical cells having carbon anodes with metal substrate.

**6489752**

**METHOD AND APPARATUS FOR CHARGING BATTERIES**

Fred S. Watts; Danh T. Trinh; USA assigned to Black and Decker Inc.

The charging method includes providing a current to the battery pack, sensing first and second battery temperatures, determining a first temperature change rate between the first and second battery temperatures, sensing a third battery temperature, determining a second temperature change rate between the second and third battery temperatures, and disabling termination of the charging method based on a temperature-based scheme if the first temperature change rate is equal to or exceeds a first predetermined threshold and the second temperature change rate is equal to or exceeds a second predetermined threshold.

**6489753**

**SYSTEM AND METHOD FOR MONITORING BATTERY EQUALIZATION**

Ciaran J. Patterson; USA assigned to C.E. Niehoff and Company

A system and method for protecting against battery overcharging is used with an automotive electrical system having an alternator that supplies an output voltage  $V_{OUT}$  to a string of at least first and second series-connected rechargeable batteries, an equalizer coupled to at least the first and second batteries, and at least a higher voltage load or a lower voltage load connected across respective sets of batteries of the string. The voltage  $V_{OUT}$  is regulated to a target value  $V_{TARGET}$ , and this target value  $V_{TARGET}$  is reduced when either the voltage  $V_1$  across the first battery exceeds a first threshold value  $T_1$  or when a voltage  $V_2$  across the second battery exceeds a second threshold value  $T_2$ . In this way, both of the batteries are protected against over-voltage conditions. A warning signal is illuminated to indicate to a user when either of the batteries is outside of its normal operating range.

**6490484**

**APPARATUS AND METHOD FOR ESTIMATING BATTERY CONDITION IN IMPLANTABLE CARDIOVERTER/DEFIBRILLATORS**

Michael W. Dooley; Gregory Scott Munson; USA assigned to Cardiac Pacemakers Inc.

An apparatus and method for determining the condition of a battery in an implantable cardioverter/defibrillator. A battery's operating status is determined from measurements of its open circuit voltage and the time required to charge an energy storage capacitor.



**6495990****METHOD AND APPARATUS FOR EVALUATING STORED CHARGE IN AN ELECTROCHEMICAL CELL OR BATTERY**

Keith S. Champlin; USA

A testing device applies time-varying electrical excitation to a cell or battery and senses the resulting time-varying electrical response. Computation circuitry within the device uses voltage and current signals derived from the excitation and response signals as inputs and computes values of elements of an equivalent circuit representation of the cell or battery. The relative charge (SOC) of the cell or battery is calculated from the value of the conductance component  $G$  of a particular parallel  $G$ - $C$  subcircuit of the equivalent circuit. The absolute charge (Ah) contained in the cell or battery is calculated from the value of the capacitance component  $C$  of a different parallel  $G$ - $C$  subcircuit. Relative or absolute charge values are then either displayed to the user or are used to control an external process such as charging of the battery.

**6495992****METHOD AND APPARATUS FOR CHARGING BATTERIES UTILIZING HETEROGENEOUS REACTION KINETICS**

Vladimir S. Pavlovic; Canada assigned to Norvik Traction Inc.

A method and apparatus utilizing a new parameter for assessing battery charge acceptance for controlling the charging process of the battery. The charge acceptance parameter comprises a terminal voltage profile which is determined during a variation in a diagnostic current. The slope of the terminal voltage profile is used in the charging process to assess the charge acceptance ability of the battery and thereby control the charging current. For a first group of batteries including lead-acid and nickel-cadmium batteries, the terminal voltage profile is characterized by an increasing profile slope as the charge acceptance ability of the battery is reached. For a second group of batteries comprising nickel-metal hydride batteries, the terminal voltage profile is characterized by a profile slope which approaches zero as the charge acceptance ability of the battery is reached.

*OTHER BATTERIES***6489056****BATTERY INCLUDING A HYDROGEN-ABSORBING CATHODE MATERIAL**

Stuart M. Davis; Enoch Wang; USA assigned to The Gillette Company

An alkaline battery has a cathode including a hydrogen absorbing material and an anode including zinc free of lead, mercury, or cadmium.

**6492046****METAL-AIR BATTERY**

Robert Payne; Gary Searle; Vance Rogers Shepard Jr.; USA assigned to The Gillette Company

A metal-air battery including (a) an anode, (b) a cathode, (c) a separator between the anode and the cathode, and (d) a container having at least one air access port has (e) a membrane between the cathode and the container that has a variable thickness.

**6496357****METAL OXIDE ELECTROCHEMICAL PSEDOCAPACITOR EMPLOYING ORGANIC ELECTROLYTE**

Hee-Young Lee; Heui-Soo Kim; Sun-Wook Kim; South Korea assigned to Ness Capacitor Company Ltd.

A novel electric energy storage system having an increased storage energy. This system includes a plurality of electrodes, an organic electrolyte including a solvent and a solute and a separator inserted between the electrodes for preventing a contact between the electrodes. According to the present invention, an organic electrolyte is used to increase the storage amount of the energy and to improve an electric conductivity. A capacitor having various designs can be manufactured.

**6500584****MANGANESE DRY BATTERIES**

Ryohei Ashihara; Tetsuya Kobayashi; Keiji Ogino; Michiko Inui; Japan assigned to Matsushita Electric Industrial Company Ltd.

It is described in the specification that a mercury-free manganese primary dry battery wherein the cathode mixture contains boric acid or an alkali borate at a ratio of 0.04–0.4 parts by weight per 100 parts by weight of manganese dioxide as a boron conversion value or wherein the separator contains boric acid or an alkali borate at a ratio of 0.1–8.0 parts by weight per 100 parts by weight of a dry solid content in the pasting agent. Such battery has excellent discharge properties under light loading conditions.