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Journal of Power Sources

LEAD ACID**6106968****SMART VALVE REGULATED LEAD ACID BATTERY WITH EMBEDDED ELECTRONIC MONITORING AND FLUID FILL SYSTEM**

Mark A. Johnson; Patrick K. Ng; UNITED STATES assigned to Lucent Technologies Inc.

For use with a valve regulated lead acid (VRLA) battery, a fluid fill system and a method of maintaining fill fluid in a VRLA battery. In one embodiment, the system includes: (1) a fluid determination circuit, associated with the battery, that determines a quantity of fill fluid in the VRLA battery and (2) a controller, coupled to the fluid determination circuit, that introduces replacement fill fluid into the VRLA battery based on the quantity to replace fill fluid lost from the VRLA battery. The fluid determination circuit comprises sensors that measure a temperature and pressure associated with the VRLA battery, and a state of a fluid release valve on the battery.

6107782**MULTI-STAGED METHOD FOR RECHARGING A LEAD ACID BATTERY AS A FUNCTION OF INTRINSIC BATTERY CHARACTERISTICS**

Hiroshi Imai; Yoshitaka Aoki; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

A method for charging a lead lead-acid battery includes a first step of charging the lead lead-acid battery to a prescribed voltage; and a second step of calculating a second charging electricity quantity based on a first charging electricity quantity to which the lead lead-acid battery is charged in the first step, and charging the lead lead-acid battery based on the second charging electricity quantity.

6110617**FLOODED LEAD ACID BATTERY WITH ROLL-OVER CAPABILITY**

Fred F. Feres; UNITED STATES assigned to Exide Corporation

A flooded lead acid battery includes a casing enclosing a plurality of cells having liquid electrolyte therein and a cover incorporating negative and positive terminals and having a plurality of vent holes. The vent holes are covered by at least one closure having a vent cavity therein, and a relatively rigid porous polytetrafluorethylene disc having hydrophobic properties is sealed within the vent cavity.

6114066**METHOD OF PRODUCING LEAD STORAGE BATTERIES**

Werner Nitsche; Norbert Lahme; Gunter Sassmannhausen; GERMANY assigned to Accumulatorenwerke Hoppecke Carl Zoellner and Sohn GmbH and Company K.G.

A method and apparatus for producing lead storage batteries are provided. Essentially grid-shaped lead electrodes are produced and are provided with a pasty, active mass. Immediately thereafter separator material is provided on both sides of the electrodes. The electrodes are stacked, electrically connected, and placed in a house to form a cell unit, which is subsequently stored to effect curing of the pasty, active mass.

6114067**CORROSION RESISTANT LEAD ALLOY FOR LEAD-ACID BATTERIES**

Davis J. Knauer; UNITED STATES assigned to East Penn Manufacturing Company Inc.

Corrosion resistant lead alloy metal for use in the battery grid of a lead acid battery. The alloy includes calcium in an amount greater than 0.06% and also includes copper. The alloy improves the life of the battery and also aids the manufacturing process by more quickly reaching the required strength for the manufacturing processes.

6117196**METHOD OF MANUFACTURING A LEAD ACID CELL PASTE AND BATTERY**

Shawn W. Snyder; Leland M. Gillman; UNITED STATES assigned to Bolder Technologies Corporation

An active paste for an lead-acid electrochemical cell which in a preferred embodiment includes tin; a method of manufacturing the same; and an electrochemical cell utilizing the same. The tin may be a tin sulfate, tin oxide, or metallic tin. The active paste sandwiches a primarily lead film which may, but need not, also include tin, to form a positive electrode. One or more positive electrodes are interleaved with a number of negative electrodes, separated by a separator material. The assembly is placed in a container and electrolyte is introduced. In alternate embodiments, the paste may include some combination of antimony, arsenic, germanium, indium, selenium, gallium, tellurium or other semiconductor materials with or without tin compounds.

6117583**LEAD BATTERY**

Ove Nilsson; Erik Sundberg; SWEDEN assigned to Advanced Power Devices Inc.

The invention concerns a lead-acid battery having all the surfaces of all the electrodes under high pressure and their circumferences kept unchanged by support from mechanically rigid cell walls such that only the thickness of the electrodes is allowed to expand under strong resilient load during the discharge and return during charge. The pressure is 0.49×10^5 – 9.81×10^5 Pa (0.5–10 kp/cm²), and may be obtained by separators or by springs applied to the outer

sides of the cell container and may be changed for increased or decreased capacity. The construction of the tubular battery design, prevents material losses due to sludging and a long working life is obtained, since also a totally corroded lead conductor under high pressure may function as a current conductor. The rigid outer containers also allow high liquid pressure and thus a high oxygen solubility and oxygen recombination for sealed cells.

6117594

ALLOY FOR BATTERY GRIDS

M. Eric Taylor; Paul D. Korinek; Christian P. Hansen; Albert Toennessen; GERMANY assigned to Johnson Controls Technology Company V.B. Autobatterie GmbH

A lead acid cell including a positive plate or grid has been discovered involving Pb/Ca/Sn/Ag alloy. An interaction between tin and silver which leads to optimum tin and silver levels which are substantially different than those indicated in the prior art. The described optimum tin and silver levels results in a positive alloy with superior mechanical properties and improved corrosion resistance which leads to superior battery life in the present day SLI applications. In a preferred manner, the alloy includes lead, tin in the range of about 0.8–1.17%, and silver in the range of greater than 0–0.015%, the percentages being based upon the total weight of the lead-based alloy.

6120934

CELL TRAY ASSEMBLY AND COVER SYSTEM FOR LEAD-ACIDS CELLS AND BATTERIES

Robert E. Linning Jr.; Bradley W. Stone; UNITED STATES assigned to G.N.B. Technologies Inc.

An electrically nonconductive cover system is provided which may be readily installed onto and removed from a cell tray assembly while minimizing the likelihood of accidental human contact with lead-acid cells or batteries. The cover system is reliable and secure and permits observation and maintenance of the cells without requiring cover removal.

FUEL CELL

6103409

FUEL CELL FLOODING DETECTION AND CORRECTION

Andrew DiPierno Bosco; Matthew Howard Fronk; UNITED STATES assigned to General Motors Corporation

Method and apparatus for monitoring an H₂–O₂ PEM fuel cells to detect and correct flooding. The pressure drop across a given H₂ or O₂ flow field is monitored and compared to predetermined thresholds of unacceptability. If the pressure drop exists a threshold of unacceptability corrective measures are automatically initiated.

6103410

START UP OF FROZEN FUEL CELL

Thomas F. Fuller; Douglas J. Wheeler; UNITED STATES assigned to International Fuel Cells Corporation

During start up, a fuel cell is warmed to operating temperature by introducing a dilute hydrogen/air mixture into the normal process oxidant channels of the fuel cell, where it reacts with a noble metal or noble metal alloy catalyst to produce heat at subflame temperatures. In one embodiment, catalyst is provided in a structure between the cathode and the process oxidant channels; if the structure is not sufficiently hydrophobic to allow the hydrogen/fuel mixture to reach it, such structure may be specially produced with hydrophobic regions to assure ice-free passages; in a structure with sufficient hydrophobic regions, only the catalyst need be added. In embodiments with a hydrophobic cathode, no structural modification is required; or a hydrophilic cathode may be provided with hydrophobic regions.

6103411

HYDROGEN PRODUCTION APPARATUS AND METHOD OPERABLE WITHOUT SUPPLY OF STEAM AND SUITABLE FOR FUEL CELL SYSTEMS

Takaaki Matsubayashi; Katsuya Oda; Yasuo Miyake; JAPAN assigned to Sanyo Electric Company Ltd.

A hydrogen production apparatus is disclosed which operates based on a steam reforming method and operates without supply of steam from outside. The hydrogen production apparatus humidifies air by allowing air to contact with warm water to generate a mixture of air and steam, mixes the mixture with a hydrocarbon fuel. Alternatively, the hydrogen production apparatus humidifies a mixture of a hydrocarbon fuel and air by allowing the mixture to contact with warm water to generate a mixed gas of the hydrocarbon fuel, air, and steam. The hydrogen production apparatus then allows air to partially oxidize the hydrocarbon fuel and allows the steam to reform the hydrocarbon fuel, resulting in the production of hydrogen.

6103412

POLYMER ELECTROLYTE FUEL CELL

Shinichi Hirano; Futoshi Fujikawa; JAPAN assigned to Mazda Motor Corporation

A polymer electrolyte fuel cell comprising a polymer electrolyte membrane, an anode catalytic electrode disposed at one side of the polymer electrolyte membrane, a fuel gas being supplied to the anode catalytic electrode, a cathode electrode disposed at another side of the polymer electrolyte, an oxidation gas being supplied to the cathode catalytic electrode, control means for controlling a reduction amount of water from the cathode electrode accompanying with the oxidation gas to a sum of a water amount increased at the cathode electrode transported from the anode electrode

through the polymer electrolyte membrane during a redox reaction of the fuel cell and a water amount produced by an oxidation reaction in the cathode electrode. A compact fuel cell system with a high cell performance can be accomplished.

6103415

FUEL CELL WITH RECTIFYING PLATES FOR UNIFORM GAS FLOW

Kenji Kurita; Katsuhiko Kajio; JAPAN assigned to Aisin Seki Kabushiki Kaisha

A fuel cell includes a plurality of laminated gas chambers, a plurality of separators that separate the gas chambers, intake passages for supplying fuel gas and oxidizing gas, exhaust passages for emitting the fuel gas and the oxidizing gas, intake ports to supply fuel gas and oxidizing gas from the intake passages to the gas chambers, exit ports to exit the fuel gas and the oxidizing gas from the gas chambers to the exhaust passages, and rectifying plates located at one end of the intake ports and extending across at least one of the gas intake passages. Each of the rectifying plates effectively restricts direct gas flow from one of the intake passages to the intake ports. Therefore, the number of gas chambers can be increased as compared to conventional fuel cells. Even though the number of gas chambers is increased, each gas chamber uniformly receives gas due to the excellent gas distribution achieved by the rectifying plates.

6106591

PROCESS FOR REDUCING CARBON PRODUCTION IN SOLID ELECTROLYTE IONIC CONDUCTOR SYSTEMS

Nitin Ramesh Keskar; Ravi Prasad; Christian Friedrich Gottzmann; UNITED STATES assigned to Praxair Technology Inc.

>A process for inhibiting the formation of carbon and/or coke from a carbon-containing reactive gas stream on the permeate side of an oxygen ion transport membrane, or for increasing the oxygen partial pressure thereon, by separating a feed gas stream to form an oxygen-depleted gas stream on the retentate side and a gas stream containing oxygen reaction products on the permeate side. The permeate side is purged with the carbon-containing reactive gas stream, and at least a portion of the exhaust gas stream formed from the reaction of the reactive gas stream with the separated oxygen is recirculated to purge the permeate side.

6106964

SOLID POLYMER FUEL CELL SYSTEM AND METHOD FOR HUMIDIFYING AND ADJUSTING THE TEMPERATURE OF A REACTANT STREAM

Henry H. Voss; Russell H. Barton; Brian W. Wells; Joel A. Ronne; Harald Anton Nigsch; GERMANY assigned to Ballard Power Systems Inc.

Reactant gas supply streams for solid polymer fuel cells may be heated and humidified using heat generated by the fuel cell and water vapor from the fuel cell exhaust. The heat and water vapor in the oxidant exhaust stream are sufficient to heat and humidify a reactant gas supply stream, preferably the oxidant supply stream. The heating and humidifying can be accomplished by flowing a reactant gas supply stream and a fuel cell exhaust gas stream on opposite sides of a water permeable membrane in a combined heat and humidity exchange apparatus. The method and apparatus are particularly suitable for use with air-cooled fuel cell systems and systems which employ near ambient pressure air as the oxidant gas supply.

6106965

POLYMER ELECTROLYTE FUEL CELL

Shinichi Hirano; Futoshi Fujikawa; JAPAN assigned to Mazda Motor Corporation

A solid polymer electrolyte fuel cell including a solid polymer electrolyte membrane, an anode side electrocatalyst electrode provided at one side of the polymer electrolyte membrane and a cathode side electrocatalyst electrode provided at the other side of the polymer, a membrane-like electrocatalyst layer permitting mass transfer thereby provided at a boundary surface of an electrocatalyst layer for an oxygen reduction reaction in the polymer electrolyte membrane in the cathode side electrocatalyst electrode, and the membrane-like electrocatalyst layer including an electrocatalyst substance. A power generation efficiency can be remarkably improved with a simple structure and advantageous cost performance in the field of a solid polymer electrolyte fuel cell.

6106967

PLANAR SOLID OXIDE FUEL CELL STACK WITH METALLIC FOIL INTERCONNECT

Anil V. Virkar; Jai-Who Kim; Kuan-Zong Fung; TAIWAN assigned to Gas Research Institute

A solid oxide fuel cell stack having a plurality of integral component fuel cell units, each integral component fuel cell unit having a porous anode layer, a porous cathode layer, and a dense electrolyte layer disposed between the porous anode layer and the porous cathode layer. The porous anode layer forms a plurality of substantially parallel fuel gas channels on its surface facing away from the dense electrolyte layer and extending from one side to the opposite side of the anode layer, and the porous cathode layer forms a plurality of substantially parallel oxidant gas channels on its surface facing away from the dense electrolyte layer and extending from one side to the opposite side of the cathode. A flexible metallic foil interconnect is provided between the porous anode and porous cathode of adjacent integral component fuel cell units.

6114058**IRON ALUMINIDE ALLOY CONTAINER FOR SOLID OXIDE FUEL CELLS**

Roddie Reagan Judkins; Prabhakar Singh; Vinod Kumar Sikka; UNITED STATES assigned to Siemens Westinghouse Power Corporation

A container for fuel cells is made from an iron aluminide alloy. The container alloy preferably includes from about 13 to 22 wt.% Al, from about 2 to 8 wt.% Cr, from about 0.1 to 4 wt.% M selected from Zr and Hf, from about 0.005 to 0.5 wt.% B or from about 0.001 to 1 wt.% C, and the balance Fe and incidental impurities. The iron aluminide container alloy is extremely resistant to corrosion and metal loss when exposed to dual reducing and oxidizing atmospheres at elevated temperatures. The alloy is particularly useful for containment vessels for solid oxide fuel cells, as a replacement for stainless steel alloys which are currently used.

6117577**AMBIENT PRESSURE FUEL CELL SYSTEM**

Mahlon S. Wilson; UNITED STATES assigned to Regents of the University of California

An ambient pressure fuel cell system is provided with a fuel cell stack formed from a plurality of fuel cells having membrane/electrode assemblies (MEAs) that are hydrated with liquid water and bipolar plates with anode and cathode sides for distributing hydrogen fuel gas and water to a first side of each one of the MEAs and air with reactant oxygen gas to a second side of each one of the MEAs. A pump supplies liquid water to the fuel cells. A recirculating system may be used to return unused hydrogen fuel gas to the stack. A near-ambient pressure blower blows air through the fuel cell stack in excess of reaction stoichiometric amounts to react with the hydrogen fuel gas.

6117579**POLYMER ELECTROLYTE FUEL CELL**

Hisaaki Gyoten; Takaharu Gamou; Kazuhito Hatou; Eiichi Yasumoto; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

The present invention is for facilitating a removal of water around the catalytic layers of a polymer electrolyte fuel cell and for providing a polymer electrolyte fuel cell which can prevent from drop in output performance caused by excessive wetting of electrode layers due to a long-hour operation or a large current outputting operation. The polymer electrolyte fuel cell according to the present invention uses an electrode layer having a water repellent porous base area and penetration areas which are higher in water permeability than in the base area. Such base area and penetration areas are formed as by imparting

water repellency unevenly on a hydrophilic pore material, for example.

6117580**CURRENT COLLECTOR FOR A FUEL CELL AND METHOD OF MAKING THE SAME**

Felix Nitschke; Joerg Wind; GERMANY assigned to Daimler Chrysler A.G.

A molten carbonate fuel cell is constructed of plural stacked individual cell units, that each, respectively, include a porous, electrolyte saturated matrix sandwiched between a cathode and an anode, and current collectors, respectively, arranged between the anode and a first separator plate, and between the cathode and a second separator plate. Especially, the cathode current collector includes a stainless steel core that is coated on at least one surface with an aluminum-containing layer. Preferably both surfaces of the stainless steel core are coated with aluminum-containing layers, except for a contact area at which the stainless steel core directly contacts the cathode. The aluminum-containing layer prevents or minimizes the occurrence of an oxidation reaction that would otherwise lead to significant loss of the electrolyte.

6117581**FUEL CELL ELECTRODE COMPRISING CONDUCTIVE ZEOLITE SUPPORT MATERIAL**

Mordecai Shelef; UNITED STATES assigned to Ford Global Technologies Inc.

A polymer–electrolyte-membrane fuel cell assembly comprising an ionomeric, conducting polymer membrane, an anode on a first face of the polymer membrane, a cathode on a second face of the polymer membrane, at least one of the anode and the cathode each comprising catalyst support material comprising conductive zeolite particulate material, and noble metal catalysts supported on the catalyst support material.

6117582**CATHODE COMPOSITION FOR SOLID OXIDE FUEL CELL**

Sten A. Wallin; Sunil D. Wijeyesekera; UNITED STATES assigned to The Dow Chemical Company

A high performance electrocatalyst is based on transition metal perovskites of praseodymium, samarium, terbium or neodymium which react with YSZ to form a product which is itself active as the cathode in a fuel cell. While PrCoO_3 reacts with YSZ, the reaction product(s) do not result in severe degradation of cell performance. A fuel cell made with a cathode composed of only the reaction product of YSZ and PrCoO_3 has good performance, indicating that this phase is itself not only a good conductor, but also a good catalyst for oxygen activation.

6120925**APPARATUS FOR AND METHOD OF REDUCING CONCENTRATION OF CARBON MONOXIDE AND FUEL-CELLS GENERATOR SYSTEM WITH SUCH APPARATUS**

Shigeyuki Kawatsu; Masayoshi Taki; JAPAN assigned to Toyota Jidosha Kabushiki Kaisha

The structure of the present invention enables all catalysts packed in a cooling layer to be kept in an active temperature range, thereby sufficiently reducing the concentration of carbon monoxide included in a hydrogen-rich gas. A supply of water is fed through a water inlet pipe 40 to a selective CO oxidizing unit 34 of a reformer 30. The heat of vaporization of the supplied water directly cools down selective CO oxidizing catalysts 50 stored in the selective CO oxidizing unit 34. This enhances the cooling efficiency and enables all the selective CO oxidizing catalysts 50 stored in the selective CO oxidizing unit 34 to be maintained in the active temperature range, thus sufficiently reducing the concentration of carbon monoxide included in a resulting gaseous fuel.

6124050**PROCESS FOR OPERATING A HIGH TEMPERATURE FUEL CELL INSTALLATION, AND HIGH TEMPERATURE FUEL CELL INSTALLATION**

Andreas Stock; GERMANY assigned to Siemens Aktiengesellschaft

A high temperature fuel cell installation includes at least one high temperature fuel cell block with an anode part and a cathode part. A process for operating the high temperature fuel cell installation includes feeding at least a portion of anode waste gas from the high temperature fuel cell block as working medium to a gas motor coupled to a generator in order to increase energy production. This measure guarantees highly efficient and flexible energy production.

6124051**FUEL CELL STACK WITH NOVEL COOLING AND GAS DISTRIBUTION SYSTEMS**

Mark C. Johnson; UNITED STATES assigned to Phoenix Analysis and Design Technologies

An electrochemical fuel cell stack is provided for converting a fuel reactant stream and an oxidant stream to a reaction product, heat, and electrical energy. The fuel cell stack includes manifolding endplates with a plurality of unit cells between, each unit cell incorporating a smooth conductive cooling layer, and anode and cathode layers incorporating gas distribution layers formed of a central, porous, sheet material and a peripheral gasket material. The cooling layer conducts heat from distant regions of the unit cell to longitudinal cooling passages which run through the length of the

stack defining a serial path through turnaround grooves in the faceplate and endplate. There is further provided a method for introducing reactant gases to the gas distribution layers. Longitudinal passages carry reactants the length of the stack and distribute gas through porous bridges to a lateral distribution channels formed along sides of the gas distribution layers, and through the gas distribution layers to exhaust. The layers of the unit cell are all relatively smooth and devoid of cooling channels.

6124052**SOLID POLYMER ELECTROLYTE FUEL CELL SYSTEM**

Hirohisa Katoh; Hidehito Kubo; Toshiro Fujii; JAPAN assigned to Kabushiki Kaisha Toyoda Jidoshokki Seisakusho

A solid polymer electrolyte type fuel cell system having a reduced size and weight, which exhibits an improved efficiency. To supply reaction gas to an anode or a cathode, a water lubricated type compressor is employed with the following operational advantages. The face pressure of sliding faces of the water lubricated type compressor, that is the compression ratio and number of revolutions thereof, can be greatly improved, as compared to the conventional oil free type compressor. The compression efficiency is improved by reducing of leakage of reaction gas between the sliding faces. No oil film is formed so as not to deteriorate the battery performance. The size of the water lubricated type compressors can be greatly reduced to about one-third to a half of the conventional oil free type compressor. In addition, the improvement of the compression efficiency and reduction of the friction loss result in a great reduction of driving power. Hence, the fuel cell system with the present arrangement is practical particularly when used as a power supply for driving a vehicle, which is severely required to have a reduced size and weight and to be economical.

6124053**FUEL CELL WITH INTERNAL COMBUSTION CHAMBER**

Randolph M. Bernard; Jeffrey Allen; UNITED STATES assigned to Fuel Cell Technologies Inc.

A novel fuel cell design is provided having a combustion chamber manifold internal to a fuel cell stack and interfacing one or more anode passage outlets and cathode passage inlets. The combustion chamber is equipped to combine a primary source of oxidant gas with an anode exhaust stream and to combust the mixture, if desired, for use as fuel within the cathode passage. The fuel cell design also provides an external gas manifold for directing carrier gas to the cathode passages upstream of the cathode passage inlets for combining with the combustion chamber exhaust prior to entry into the cathode passages.

6124054**PURGED ANODE LOW EFFLUENT FUEL CELL**

Michael E. Gorman; Bryan L. Murach; UNITED STATES assigned to International Fuel Cells L.L.C.

A hydrogen-fueled fuel cell reacts residual fuel in the exhaust of the anode flow field either in a catalytic converter or by feeding the anode exhaust into the cathode oxidant stream. Control of flow of anode exhaust into the cathode oxidant stream may be in response to a flammability sensor, a gas composition analyzer, current output, or periodically in response to a timer; the anode exhaust may be fed either upstream or downstream of the cathode air inlet blower.

BATTERY MATERIALS**6099988****PROTON CONDUCTING POLYMER ELECTROLYTE PREPARED BY DIRECT ACID CASTING**

Robert F. Savinell; Morton H. Litt; UNITED STATES assigned to Case Western Reserve University

An acid solution for casting solid polymer electrolyte membranes comprising proton conducting polymers stable at temperatures in excess of 100°C directly from acid solution. The invention further relates to the enhanced performance of these membranes with respect to conductivity. Particularly, the invention relates to the use of trifluoroacetic acid (TFA) as an acid solvent doped with H₃PO₄ from which polybenzimidazole (PBI) solid polymer electrolyte membranes may be cast.

6099990**CARBON ELECTRODE MATERIAL FOR ELECTROCHEMICAL CELLS AND METHOD OF MAKING SAME**

Frank R. Denton III; Daryl R. Smith; UNITED STATES assigned to Motorola Inc.

A method of fabricating a microscopically dense amorphous carbon material for use as an electrode in an electrochemical cell includes the steps of mixing a lignin material with a matrix-enhancing salt, and subsequently heating the mixture.

6103319**BATTERY ELECTRODE SUBSTRATE AND PROCESS FOR PRODUCING THE SAME**

Keizo Harada; Kenichi Watababe; Shosaku Yamanaka; Kiyoshi Hayashi; Nobuyasu Morishita; Hiroki Takeshima; Hideo Kaiya; Munehisa Ikoma; JAPAN assigned to Sumitomo Electric Industries Ltd. and Matsushita Electric Industrial Company Ltd.

A battery electrode substrate which is constituted of a porous metallic body structure having communicating pores at a porosity of at least 90% and an Fe/Ni multilayer structure,

where the skeletal portion of the porous metallic body is composed mainly of Fe and has an Ni covering layer on the surface thereof, while pores communicating with the inside and outside of Fe skeletal portion exist in the Fe skeletal portion and the inside of the pores is covered with Ni. The electrode substrate is produced by applying an iron oxide powder of at most 20 μm in an average particle size on a porous resin core body; heat treating the core to remove an organic resin component while simultaneously sintering Fe to obtain a porous Fe body; and then covering the Fe skeletal portion with Ni by electroplating. In this process, the iron oxide can be used in combination with carbon powder. Further, a nickel porous sintered body can also be produced using nickel oxide in place of iron oxide.

6103413**BIPOLAR PLATES FOR ELECTROCHEMICAL CELLS**

Carlos E. Hinton; Carey L. Scortichini; Robert D. Mussell; UNITED STATES assigned to The Dow Chemical Company

A bipolar separator plate for two electrochemical cells connected in series, the plate having two layers of a porous electronically conductive material having positioned there between a solid layer of a polymeric material having dispersed therein at least 1% by weight of a conductive filler, where the plate has an area resistivity of less than 1 Ω cm², and the solid layer has a permeability of less than 50 μD (mu Darcy).

6103414**BLEND MEMBRANES BASED ON SULFONATED POLY(PHENYLENE OXIDE) FOR POLYMER ELECTROCHEMICAL CELLS**

Israel Cabasso; Youxin Yuan; Cortney Mittelsteadt; UNITED STATES assigned to The Research Foundation of State University of the New York

Solid polymer membranes comprised of a high charge density sulfonated poly(phenylene oxide) blended with poly(vinylidene fluoride) in varied ratios have improved membrane characteristics. These membranes are inexpensive and possess very high ionic conductivity, and thus are suitable for solid polymer electrolytes in electrochemical applications, especially for the polymer electrolyte membrane (PEM) fuel cell, the electrolyte double-layer capacitor, and the rechargeable zinc-halide cell. These membranes enhance the performance of these devices.

6103422**CATHODE ACTIVE MATERIAL AND NON-AQUEOUS SECONDARY BATTERY CONTAINING THE SAME**

Hiroyuki Kanai; JAPAN assigned to Kao Corporation

The powdery cathode active material of the present invention for use in a non-aqueous electrolyte secondary battery

comprises as the active ingredient: a lithium manganese composite oxide and at least one nonmanganese metal element selected from the group consisting of aluminum, magnesium, vanadium, chromium, iron, cobalt, nickel, and zinc, provided that the nonmanganese metal element exists in the surface portions of fine particles constituting the powdery cathode active material. A non-aqueous electrolyte secondary battery comprising such a cathode active material, an anode active material and a non-aqueous electrolytic solution containing a lithium salt has a large charge-and-discharge capacity and a stable charge-and-discharge cycle durability, and can be prepared inexpensively.

6103423

NEGATIVE ELECTRODE FOR SECONDARY CELLS AND A NON-AQUEOUS ELECTROLYTE SECONDARY CELL COMPRISING THE SAME AS AT LEAST ONE ELECTRODE

Toshiki Itoh; Kenji Yamamoto; Eiichi Okuno; Hiroshi Ueshima; JAPAN assigned to Denso Corporation

A negative electrode comprises carbon particles which individually consist of a core of crystalline carbon and an amorphous carbon layer formed on at least a part of the surfaces of the core, and an amorphous carbon matrix dispersing the carbon particles therein. The carbon matrix is formed by thermal decomposition of a thermosetting resin. A non-aqueous electrolyte secondary cell which comprises an electrode of the type mentioned above as at least one of electrodes is also described.

6106974

BIPOLAR ELECTRODE FOR BATTERY WITH ALKALINE ELECTROLYTE

Guy Bronoel; Noelle Tassin; FRANCE assigned to Laboratoires Sorapec Societe Anonyme

A bipolar electrode for alkaline batteries, including a conductive screen, a tridimensional collector provided with asperities which is plated on each side of the conductive screen, active material filling the collectors in order to constitute positive and negative electrodes, respectively, where at least one of each side of the conductive screen is grooved and the tridimensional collector is affixed to the conductive screen by means of a non-conductive adhesive, stable in the presence of a highly alkaline electrolyte, in direct contact with the external sides of the conductive screen by means of the asperities of the tridimensional collector.

6108879

METHOD OF MAKING RESILIENT BATTERY SEPARATOR MEDIA

Don August Forte; Joseph Rumiesz Jr.; Michael John Cusick; Phillip Charles Martin; UNITED STATES assigned to Johns Manville International Inc.

Resilient battery separator media, especially adapted for use as battery separators for starved electrolyte batteries, are formed from air laid, fibrous mats of randomly oriented, entangled microfibers which may be needled to further entangle the fibers. The fibrous mats may be essentially uniform in density throughout their thickness or may include one or two relatively high density, high tensile strength fibrous surface layer(s) and a relatively low density, more resilient fibrous layer integral with and, in one embodiment, intermediate the two surface layers, where the fibers in the surface layer(s) of the mats are more entangled than the fibers in the resilient layer. The fibrous mats, with one or two surface layers, are formed from the air laid fibrous mats by further entangling the fibers at and adjacent one or both surfaces of the mats, e.g. through hydroentanglement, relative to the entanglement of the fibers in the resilient fibrous layer. The fibrous mats with substantially uniform densities may be made by flooding the air laid mats with a liquid and drawing a vacuum through the mats. Preferably, no organic binders are used in the mats. However, the fibers of the mats may be treated with an acid solution to hydrolyze the surfaces of the fibers and bond the entangled fibers together at their points of intersection.

6110304

HYDROGEN-ABSORBING ALLOY ELECTRODE FOR ALKALINE STORAGE BATTERIES

Mitsuzo Nogami; Yoshinori Matsuura; Mamoru Kimoto; Nobuyuki Higashiyama; Mitsunori Tokuda; Takahiro Isono; Ikuo Yonezu; Koji Nishio; JAPAN assigned to Sanyo Electric Company Ltd.

The hydrogen-absorbing alloy electrode for alkaline storage batteries according to the invention comprises a hydrogen-absorbing alloy powder prepared by grinding a strip of hydrogen-absorbing alloy produced by solidifying a molten alloy by a roll method and satisfying the following relations, where r represents the mean particle size (μm) of the hydrogen-absorbing alloy powder and t represents the mean thickness (μm) of the strip absorbing alloy. The hydrogen-absorbing alloy electrode of this invention features an improved high-rate discharge characteristic at low temperature.

6117591

HYDROGEN FLUORIDE ADDITIVE FOR NON-AQUEOUS ELECTROLYTE IN ALKALI METAL ELECTROCHEMICAL CELLS

Esther S. Takeuchi; Randolph A. Leising; UNITED STATES assigned to Wilson Greatbatch Ltd.

An alkali metal, solid cathode, non-aqueous electrochemical cell capable of delivering high current pulses, rapidly recovering its open circuit voltage and having high current capacity, is described. The stated benefits are realized by the addition of hydrogen fluoride to the non-aqueous

electrolyte comprising an alkali metal salt dissolved in a mixture of a low viscosity solvent and a high permittivity solvent. A preferred solvent mixture includes propylene carbonate, dimethoxyethane and hydrogen fluoride having LiAsF_6 or LiPF_6 dissolved therein.

6117592

PORUS METALLIC MATERIAL HAVING HIGH SPECIFIC SURFACE AREA, METHOD OF PRODUCING THE SAME, PORUS METALLIC PLATE MATERIAL AND ELECTRODE FOR ALKALINE SECONDARY BATTERY

Kouji Hoshino; Yoshitaka Mayuzumi; Tohru Kohno; Norikazu Komada; JAPAN assigned to Mitsubishi Materials Corporation

The porous metallic material of the present invention has an overall porosity of 80–99%, and a skeleton in a three-dimensional network structure which is entirely composed of a sintered metal powder having a porosity of 10–60%. The specific surface area is very high, for example, 300–11,000 cm^2/cm^3 . The porous metallic material can be reinforced by a reinforcing plate. The porous metallic material is also suitable for an electrode of an alkaline secondary battery and enables achievement of increases in the life and the amount of the active material contained therein. The porous metallic material can be produced by preparing a foamable slurry containing a metal powder, forming the foamable slurry, drying the formed product, preferably after foaming, and finally burning the dry formed product.

6117595

HIGH SODIUM ION CONDUCTING INORGANIC COMPOSITE SOLID ELECTROLYTE AND METHOD FOR PRODUCTION THEREOF

Tomonari Takeuchi; Elisabeth Betourne; Mitsuharu Tabuchi; Osamu Nakamura; Hiroyuki Kageyama; JAPAN assigned to Agency of Industrial Science and Technology and Ministry of International Trade and Industry

A high sodium ion conducting inorganic composite solid electrolyte obtained by mixing $\text{Na}_4\text{Zr}_2\text{Si}_3\text{O}_{12}$ with titanium oxide and sintering the resultant mixture and a method for the production of a high sodium ion conducting inorganic composite solid electrolyte, consisting essentially of the steps of mixing $\text{Na}_4\text{Zr}_2\text{Si}_3\text{O}_{12}$ with titanium oxide and sintering the resultant mixture.

6120565

METHOD FOR FORMING BATTERIES COMPRISING POLYMERIC BINDER MATERIAL

Eric R. Dix; Weihong Li; UNITED STATES assigned to Micron Technology Inc.

The method encompasses batteries, battery electrodes and methods of forming batteries and battery electrodes.

In one aspect, the invention includes a mixture of PTFE and a compound selected from the group consisting of PVDF, copolymers of vinylidene fluoride and hexafluoropropylene, and mixtures thereof in a cathode binder. In another aspect, the invention includes a battery electrode comprising PTFE and a compound selected from the group consisting of PVDF, copolymers of vinylidene fluoride and hexafluoropropylene, and mixtures thereof. In another aspect, the invention includes a battery comprising: (a) a cathode; (b) an anode and (c) where at least one of the cathode or the anode comprises PTFE and a compound selected from the group consisting of PVDF, copolymers of vinylidene fluoride and hexafluoropropylene, and mixtures thereof. In another aspect, the invention includes a method of making a battery comprising: (a) providing a cathode; (b) providing an anode, where at least one of the cathode or the anode comprises PTFE and a compound selected from the group consisting of PVDF, copolymers of vinylidene fluoride and hexafluoropropylene, and mixtures thereof and (c) incorporating the cathode and the anode into a battery.

6120924

PEROVSKITE-TYPE OXIDE MATERIALS CONTAINING NICKEL AND IRON FOR AIR ELECTRODE AND SOLID OXIDE FUEL CELL USING THE SAME

Reiichi Chiba; Fumikatsu Yoshimura; Yoji Sakurai; JAPAN assigned to Nippon Telegraph and Telephone Corporation

A solid oxide fuel cell, which converts a chemical reaction between a fuel and air or oxygen into electric energy, and which is constructed by a solid electrolyte, an air electrode mounted adjacent to the solid electrolyte, a fuel electrode, and an inter-connector for connecting with other cell units is provided. The air electrode of the above fuel cell is made of a perovskite-type oxide material with a composition expressed by $\text{LnNi}_{1-x}\text{Fe}_x\text{O}_3$ and $\text{YNi}_{1-x}\text{Fe}_x\text{O}_3$ and where Ln represents lanthanide elements and x is in a range of 0.30–0.60. The perovskite-type oxide materials containing nickel and iron satisfy requirements to provide higher electronic conductivity than the conventional material and closer thermal expansion coefficient to that of the solid electrolyte than that of the conventional air electrode material.

6120927

METHOD OF RECOVERING LITHIUM FROM BATTERIES

Masaru Hayashi; Motonaka Yabuki; Masayuki Onuma; Fuminobu Tezuka; Yuki Tomioka; JAPAN assigned to Kabushiki Kaisha Toshiba

Disclosed is a method of recovering lithium from a battery containing lithium such as a lithium ion secondary battery. The lithium-containing member of the battery is dissolved

with an acidic liquid, and an alkaline material is added to the obtained lithium solution to transform a transition metal which may be dissolved in the lithium solution into a metal hydroxide precipitation, whereby the metal hydroxide precipitate is separated from the lithium solution. The lithium solution is then dried to obtain a solid containing the lithium, and the lithium is eluted from the solid with a non-aqueous solvent. Retrieving lithium from the lithium eluate is accomplished by use of a cation exchanger.

6120940

ELECTROCHEMICAL STORAGE CELL CONTAINING AT LEAST ONE ELECTRODE FORMULATED FROM A PHENYLENE-THIENYL BASED POLYMER

Theodore O. Poehler; Peter Searson; Jeffrey Gilbert Killian; Haripada Sarker; Jennifer Giaccari; Yosef Gofer; ISRAEL assigned to The Johns Hopkins University

An electrochemical storage cell or battery including, as at least one electrode, at least one electrically conductive polymer, the polymer being poly(1,4-bis(2-thienyl)-3-fluorophenylene), poly(1,4-bis(2-thienyl)-2,5-difluorophenylene), poly(1,4-bis(2-thienyl)-2,3,5,6-tetrafluorophenylene), or poly(1,4-bis(2-thienyl)-benzene). These polymeric electrodes have remarkably high charge capacities, and excellent cycling efficiency. The provision of these polymeric electrodes further permits the electrochemical storage cell to be substantially free of metal components, thereby improving handling of the storage cell and obviating safety and environmental concerns associated with alternative secondary battery technology.

6120984

SOLID ELECTROLYTE PARTICLES COMPRISING MAg_4I_5

Thomas N. Blanton; Seshadri Jagannathan; Mark E. Irving; UNITED STATES assigned to Eastman Kodak Company

This invention comprises a process for generating particles of MAg_4I_5 , where M is a monovalent cation, which comprises dissolving AgI and MI in a polar solvent followed by precipitating particles of MAg_4I_5 by adding the solution to a nonpolar solvent. The resulting MAg_4I_5 is in the form of anisotropic crystalline particles. The MAg_4I_5 particles can be used in the preparation of a photothermographic element. The invention also comprises method of preparing a stable aqueous emulsion of MAg_4I_5 particles.

6124058

SEPARATOR FOR A BATTERY COMPRISING A FIBRILLATABLE FIBER

Akio Ohmory; Hayami Yoshimochi; Tomoyuki Sano; Satoru Kobayashi; Syunpei Naramura; Masahiro Satoh; JAPAN assigned to Kuraray Company Ltd. and Matsushita Electric Industrial Company Ltd.

A fiber of sea-islands phase separation, where the sea component comprises a vinyl alcohol based polymer with high orientation and great crystallinity and the islands component comprises a water-insoluble cellulose based polymer with excellent absorptivity of alkaline solutions, thermal resistance and heat fusion resistance, and where the size of the islands is 0.03–10 μm and the strength is 3 g/d or more, is readily disintegrated into a fibril of a diameter of 0.05–8 μm when a mechanical stress is imposed onto the fiber wet in water. From the fibril with good hydrophilicity, high strength, great particle captivity and excellent reinforcing performance, and additionally with good absorptivity of alkaline solutions and great thermal resistance and heat fusion resistance, none of the fiber components therein is solubilized during fibrillation. Neither a beating process nor a beating solution causes foaming or environmental pollution. The fibril is extremely useful for use in separator sheets for alkaline batteries, reinforcing fibers of cement slate plates, reinforcing fibers of frictional materials and the like.

6124060

SOLID POLYMER ELECTROLYTES

Hiroshi Akita; Masao Ichikawa; Katsutoshi Nosaki; Hiroyuki Oyanagi; Masaru Iguchi; JAPAN assigned to Honda Giken Kogyo Kabushiki Kaisha

This invention provides a solid polymer electrolyte which is low in water absorption, from which no dopant runs out even in pressing, and which is excellent in stability in the presence of water or methanol, proton conductivity and methanol barrier properties, in which an imidazole ring-containing polymer such as a polybenzimidazole compound is doped with an acid in which at least one hydrogen atom of an inorganic acid such as phosphoric acid is substituted by a functional group having a phenyl group by blending the imidazole ring-containing polymer with the acid in a solution using a solvent such as trifluoroacetic acid, preferably at a rate of 1–10 molecules of the acid per repeating structure unit of a molecular chain of the imidazole ring-containing polymer, the solid polymer electrolyte.

LITHIUM BATTERIES

6103213

PROCESS FOR PRODUCING LITHIUM-COBALT OXIDE

Tatsuya Nakamura; Hideaki Sadamura; Mitsuaki Hatatani; Akihisa Kajiyama; Yoshiro Okuda; JAPAN assigned to Toda Kogyo Corporation

A process for producing lithium-cobalt oxide comprises: mixing cobalt oxide having a BET specific surface area of 30–200 m^2/g or an average particle size of not more than 0.1 μm with a lithium compound; and calcining the obtained mixture at a temperature of 500–850°C. Such a process for producing lithium-cobalt oxide particles is useful especially

as a cathode active substance for lithium ion batteries, which particles can be produced by calcination in a short time, and have a narrow particle size distribution and a uniform small particle size.

6103416

LAMINATED LITHIUM-ION CELL AND PROCESS FOR FABRICATING SAME

Peter Bauerlein; Johanna Oberhauser; Hans-Walter Praas; Hermann Schomann; GERMANY assigned to Varta Batterie Aktiengesellschaft

The invention relates to a laminated lithium-ion cell which comprises flexible layers, where the negative electrode is lithium metal, lithium alloy or a metallic bonded fiber web or a foam, which comprises a lithium-intercalating material such as carbon, graphite, tungsten dioxide, molybdenum dioxide, titanium dioxide, titanium disulfide or vanadium pentoxide as the active component, the separator is made of a porous polymer in which a non-aqueous electrolyte is immobilized, and the positive electrode as the active material comprises lithiated manganese dioxide, manganese spinel, lithium-metal oxides, lithium-metal mixed oxides or lithium-metal sulfides.

6103419

SOLID SECONDARY LITHIUM CELL BASED ON LITHIATED ZIRCONIUM, TITANIUM OR HAFNIUM OXIDE CATHODE MATERIAL

M. Yazid Saidi; Jeremy Barker; Rene Koksang; DENMARK assigned to Valence Technology Inc.

Provided by the present invention is a new cathode material comprised of a lithiated zirconium, titanium or hafnium oxide. The oxide is of the formula Li_2MXO_4 , where M is preferably a transition metal such as Ni, Co, Fe, Mn, V, Cu, or Cr, and X is zirconium, titanium or hafnium. The cathode material provides a useful composite cathode when combined with a polymeric binder and carbon.

6103420

CATHODE FOR LITHIUM SECONDARY BATTERY AND PRODUCTION METHOD FOR THE SAME

Kenji Nakane; Yasunori Nishida; Kenichiro Kami; Tomoari Satoh; JAPAN assigned to Sumitomo Chemical Company Limited

The invention provides a cathode for a lithium secondary battery including lithiated nickel dioxide with a large discharge capacity as an active material and having a high density, so that a larger amount of the active material can be charged in a battery container with a limited volume, a production method for the same and a lithium secondary battery utilizing the cathode. The cathode for a lithium secondary battery includes lithiated nickel dioxide as an active material, and the lithiated nickel dioxide is produced

by firing a mixture of a lithium compound and a nickel compound at a temperature ranging between 350 and 800°C. The supernatant obtained by dispersing 5 g of the lithiated nickel dioxide in 100 cm³ of water in a glass vessel for 5 min and allowing the resultant solution to stand for 30 s has a pH of 12.00 or less. The production method includes the steps of obtaining the lithiated nickel dioxide as above and treating or milling the lithiated nickel dioxide in an atmosphere including carbon dioxide.

6103421

PROCESS OF PRODUCING A POSITIVE ELECTRODE ACTIVE MATERIAL AND NON-AQUEOUS SECONDARY BATTERY USING THE SAME

Naoto Torata; Takehito Mitate; Kazuaki Minato; JAPAN assigned to Sharp Kabushiki Kaisha

A process of preparing a positive electrode active material for a non-aqueous secondary battery comprising: making a buffered aqueous solution of a water-soluble lithium compound and a water-soluble nickel compound having a definite pH, reacting with oxalic acid and a water-soluble lithium compound and a water-soluble nickel compound to yield a coprecipitate of a slightly water-soluble salt of lithium and nickel in the resulting aqueous solution, followed by calcination.

6106976

SECONDARY BATTERY OR CELL WITH A NON-AQUEOUS ELECTROLYTE

Yoshiyuki Ozaki; Nobuo Eda; Akiyoshi Morita; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

A secondary battery with non-aqueous electrolyte having a high voltage and capacity and an improved cycle property, characterized in that the battery has an anode which is comprised of graphite spherical particles provided with a lamellar structure and an optically anisotropic and single phase such as meso-carbon microbeads; and a cathode which is comprised of composite oxides containing lithium.

6106977

LITHIUM SECONDARY CELLS AND METHODS FOR PREPARING ACTIVE MATERIALS FOR NEGATIVE ELECTRODES

Yuukichi Kobayashi; Hidehiko Ohara; Kenji Watanabe; Kazuo Niwa; JAPAN assigned to Mitsubishi Chemical Corporation

A lithium secondary cell, where a carbon material treated with a fluorinating agent and having substantially no C-F covalent bond, is used as an active material for negative electrode, provides a secondary cell having improved cell life. Further, a lithium secondary cell, where a carbon material treated with a fluorinating agent and having an amount of fluorine extractable with an aqueous alkaline

solution being at most 0.05 wt.%, is used as an active material for negative electrode, or a lithium secondary cell, where a carbon material treated with a fluorinating agent and containing lithium, is used as an active material for negative electrode, provides a secondary cell which is free from a problem of expansion of the casing during charging due to fluorine remaining in a small amount in the cell.

6110442**METHOD OF PREPARING $\text{Li}_x\text{Mn}_2\text{O}_4$ FOR LITHIUM-ION BATTERIES**

Dinggue Xia; Qingguo Liu; CHINA assigned to Hughes Electronics Corporation

A method of preparing $\text{Li}_x\text{Mn}_2\text{O}_4$ for a secondary battery includes mixing lithium nitrate, manganese nitrate and citric acid. A complex citrate solution is formed in the substantial absence of a polyhydroxyl alcohol. The complex citrate solution is dehydrated to produce a precursor. The precursor is then heated at a substantially constant rate and then calcined to provide a spinel compound.

6110621**CARBONS FOR LITHIUM BATTERIES PREPARED USING SEPIOLITE AS AN INORGANIC TEMPLATE**

Giselle Sandi; Randall E. Winans; K. Carrado Gregar; UNITED STATES assigned to The University of Chicago

A method of preparing an anode material using sepiolite clay having channel-like interstices in its lattice structure. Carbonaceous material is deposited in the channel-like interstices of the sepiolite clay and then the sepiolite clay is removed leaving the carbonaceous material. The carbonaceous material is formed into an anode. The anode is combined with suitable cathode and electrolyte materials to form a battery of the lithium-ion type.

6114062**ELECTRODE FOR LITHIUM SECONDARY BATTERY AND METHOD FOR MANUFACTURING ELECTRODE FOR LITHIUM SECONDARY BATTERY**

Hikaru Motomura; Kazuhiro Hasezaki; JAPAN assigned to Mitsubishi Heavy Industries Ltd.

It is the object of the present invention to provide an electrode for a lithium secondary battery that employs a binding agent which increases the adhesion between the particles of the active material for the electrode, or between the active material for the electrode and a metallic collector, without requiring an organic solvent during the production of the electrode. The present invention's lithium secondary battery electrode is provided with an active material for an electrode and a binding agent comprising a bis-allylnadiimide compound or an allylnadiimide compound, which are

water-dispersible, low molecular weight addition polymerized imide monomers, where the electrolytically active particles are held together by the binding agent.

6114065**SECONDARY BATTERY**

Kaoru Inoue; Takafumi Oura; Masaki Kitagawa; Hizuru Koshina; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

A cell capable of preventing precipitation of lithium on a negative electrode plate in the final stage of a cycle life and achieving a superior cycling performance and high safety and reliability is provided. In a rechargeable secondary cell using a non-aqueous electrolyte, a positive electrode contains an active material and a conductive element, and Ketjenblack, a mixture of Ketjenblack and flake graphite or a mixture of Ketjenblack and acetylene black is employed as such conductive element.

6114068**SHEET FOR FORMING A POLYMER GELLED ELECTROLYTE, A POLYMER GELLED ELECTROLYTE USING IT, AND A METHOD FOR MANUFACTURE THEREOF**

Teruyuki Yamada; Seiji Hayashi; Yoshihiko Hosako; Mitsuo Hamada; JAPAN assigned to Mitsubishi Rayon Company Ltd.

The present invention provides a unique fibrous sheet for forming a polymer gel electrolyte having ion conductivity, a unique polymer gel electrolyte using such a sheet, and a unique method for the manufacture thereof. More specifically, the present invention provides a unique fibrous sheet for forming a polymer gel electrolyte having excellent ion conductivity and suitable as an electrolyte for various electronic devices such as lithium primary batteries, lithium secondary batteries, and electric double layer capacitors, as well as a unique polymer gel electrolyte using such a sheet, and also a unique method for the manufacture thereof.

6114069**POLYMER ELECTROLYTE LITHIUM BATTERY CONTAINING A POTASSIUM SALT**

Yves Choquette; Michel Armand; Martin Simoneau; Rene Gahnon; Andre Belanger; CANADA assigned to Hydro Quebec

In a rechargeable lithium battery including inter alia a lithium anode, a lithium ion reducible cathode bonded with a polymer, as well as a polymer electrolyte, potassium ions are introduced either in the cathode or in the electrolyte, or in both of them at the same time, so that potassium is distributed in the cathode and the electrolyte when the generator has reached equilibrium. This has the effect of stabilizing the performances of the battery during cycling in terms of energy and power.

6114070**LITHIUM SECONDARY BATTERY**

Toshikazu Yoshida; Ryuji Ohshita; Masahisa Fujimoto; Toshiyuki Nohma; Koji Nishio; JAPAN assigned to Sanyo Electric Company Ltd.

A lithium secondary battery comprising a non-aqueous electrolyte obtained by dissolving an electrolytic salt in a solvent, a negative electrode comprising a negative electrode material and a positive electrode comprising a positive electrode active material, the electrolytic salt comprising: at least one electrolytic salt A selected from the group consisting of LiPF_6 , LiAsF_6 , LiSbF_6 , LiBF_4 , LiBiF_4 , LiAlF_4 , LiGaF_4 , LiInF_4 and LiClO_4 , and at least one electrolytic salt B selected from the group consisting of $\text{LiN}(\text{C}_n\text{F}_{2n+1}\text{SO}_2)_2$, where n is an integer of 1, 2, 3 or 4 and $\text{LiC}(\text{C}_m\text{F}_{2m+1}\text{SO}_2)_3$, where m is an integer of 1, 2, 3 or 4. The battery is superior in the aspects of storage characteristic in a charged condition.

6117589**LITHIUM BATTERY WITH ROUGHENED ELECTRODE TAB**

Kouichi Satou; Kazunari Ookita; Yoshito Chikano; Mitsuzou Nogami; Ikuo Yonezu; Koji Nishio; JAPAN assigned to Sanyo Electric Company Ltd.

A lithium battery and method for manufacturing the lithium battery are provided. The battery includes electrodes formed of a layer of an active material, the active material being capable of occluding and discharging lithium electrochemically, provided on the surface of a current collector, electrode external terminals for providing electricity to the outside of the battery, and an electrode tab joined at an end thereof to a surface of said current collector and at another end thereof to an electrode external terminal. The electrode tab has a roughened surface at the end joined to the current collector, and the roughened surface is welded to the surface of said current collector. The roughened surface is produced by chemical etching, abrasion by an abrasive, abrasion by ultrasonic waves or by blasting with an abrasive.

6117596**ORGANIC ELECTROLYTE AND LITHIUM SECONDARY CELL EMPLOYING THE SAME**

Doo-yeon Lee; Seok-gwang Doo; Yuong-soo Son; Bokhwan Jung; SOUTH KOREA assigned to Samsung Electronics Company Ltd.

An organic electrolyte containing an organic solvent mixture and a lithium (Li) salt, and a lithium secondary cell adopting the electrolyte. The organic electrolyte contains the organic solvent mixture comprising a solvent having a high dielectric constant, a solvent having a low viscosity and a compound expressed by the following chemical formula (1): ##STR1##, where R_1 and R_2 are independently C_1 – C_3 linear or cyclic alkyl, and x an integer from 1 to 4. The organic electrolyte for

a lithium secondary cell is improved in ion conductivity, low-temperature storage characteristics, and a wide potential window region. Also, the lithium salt may be a mixture of inorganic lithium salts and organic lithium salts. A lithium secondary cell adopting the electrolyte containing both inorganic lithium salts and organic lithium salts has a large capacity and stable charging/discharging characteristics, thereby improving high-temperature characteristics, self-discharging characteristics as well as life span characteristics.

6120938**NON-AQUEOUS ELECTROLYTE SECONDARY CELL**

Yoshinori Atsumi; Masayuki Nagamine; JAPAN assigned to Sony Corporation

A non-aqueous electrolyte secondary battery is disclosed in which hydrogen lithium titanate prepared by an acid process of lithium titanate and having pH of 11.2 or smaller or hydrogen lithium titanate expressed by general formula $\text{H}_x\text{Li}_{y-x}\text{Ti}_z\text{O}_4$ (where y is greater than or equal to $x > 0$, 0.8 less than or equal to y less than or equal to 2.7 and 1.3 less than or equal to z less than or equal to 2.2) is employed as an active material for an electrode. Hydrogen lithium titanate may be employed as an active material for a positive electrode or a negative electrode. Thus, a charging capacity greater than a theoretical capacity is realized. It is preferable that hydrogen lithium titanate is formed into a particle shape and includes voids in the particles. It is preferable that the largest particle size is 0.1–50 μm and the specific surface area is 0.01–300 m^2/g .

6124061**LITHIUM ION SECONDARY BATTERY**

Kouji Hamano; Yasuhiro Yoshida; Hisashi Shiota; Shou Shiraga; Shigeru Aihara; Michio Murai; Takayuki Inzuka; JAPAN assigned to Mitsubishi Denki Kabushiki Kaisha

To obtain a lithium ion secondary battery having excellent charge and discharge characteristics in which electric connection between electrodes can be maintained without requiring a strong armor metal case, so that it can be made into thin forms having large energy density. A positive electrode prepared by bonding a positive electrode active material layer to a positive electrode collector, a negative electrode prepared by bonding a negative electrode active material layer to a negative electrode collector and a separator which is arranged between these two electrodes and keeps a lithium ion-containing electrolytic solution are closely adhered by bonding the positive electrode active material layer and the negative electrode active material layer to the separator by a porous adhesive resin layer, and an electrolytic solution is kept in through holes formed in the adhesive resin layer, which communicate the positive electrode active material layer and the negative electrode active material layer with the separator.

NICKEL METAL HYDRIDE BATTERIES

6099991

ELECTRODE FOR ALKALINE STORAGE BATTERIES AND PROCESS FOR PRODUCING THE SAME

Toru Inagaki; Hiroki Takeshima; Kazushige Sugimoto; Hideo Kaiya; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

An electrode excellent in high-rate discharge characteristics is provided by increasing the adhesive strength of the conductive core material to the sintered nickel porous body which form the sintered type substrate. The electrode of the present invention uses a sintered substrate containing a part, where the diameter of the pores of the sintered nickel porous body becomes successively smaller from the joining interfaces of the conductive core material toward the outside surfaces of the substrate. The region where the diameter is greater than in other parts preferably ranges within about 1/5 of the substrate thickness starting from both surfaces of the core material toward the outside surfaces of the substrate.

6110433

PROCESS FOR THE RECOVERY OF METALS FROM USED NICKEL/METAL/RARE EARTH HYDRIDE STORAGE BATTERIES

Klaus Kleinsorgen; Uwe Kohler; Alexander Bouvier; Andreas Folzer; AUSTRIA assigned to Varta Batterie Aktiengesellschaft

The invention relates to a process for recovering metals from used nickel/hydride storage batteries, in which storage battery scrap has been mechanically comminuted and divided into at least a coarse fraction and a fine fraction capable of being treated separately from one another. The process comprises the steps of digesting and dissolving the fine fraction with a mixture of sulfuric acid and hydrogen peroxide, performing a double sulfate precipitation of the rare earths by raising the pH, performing a precipitation of the iron and of the aluminum by further raising the pH, performing a solvent extraction of other metals to separate nickel and cobalt which remain in the aqueous phase from the other metals which are extracted into the organic phase. Optionally, the nickel and the cobalt can be separated from each other and, if desired, the mixed-metal rare earth component which has been recovered can be melted together with cobalt and nickel alloy for the fabrication of new batteries.

6111389

RAPIDLY CHARGING A BATTERY WITHOUT OVERCHARGING

Gene Aranovich; David C. Nall; Claudio Spinelli; Edwin A. Muth; UNITED STATES assigned to Lucent Technologies Inc.

In the rapid charging of a nickel cadmium (NiCad) battery, the rapid charging is terminated and trickle charging is initiated when any of three conditions is satisfied: a first condition determined by comparing a sensed instantaneous battery voltage with a target voltage; a second condition which is determined by comparing the instantaneous battery temperature with minimum and maximum values; and a third condition determined by comparing an elapsed time of rapid charging with a maximum value. Because battery voltage versus rapid charging time is a function of ambient temperature, the target voltage is determined from an initial measurement of battery temperature, which is assumed to equal the ambient temperature. The target voltage, which is approximately a linearly declining function of ambient temperature, is determined by reading a stored lookup table using the sensed temperature as an index or address.

6114063

ALKALINE STORAGE BATTERY AND METHOD FOR TREATING SURFACE OF POSITIVE ELECTRODE ACTIVE MATERIAL THEREOF

Masumi Katsumoto; Norikatsu Akutsu; Takeshi Yao; Yasuharu Yamamura; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

An alkaline storage battery comprises a positive electrode prepared by filling a nickel hydroxide in a porous plaque as an active material, a negative electrode, a separator and an alkaline electrolyte, the positive electrode containing the nickel hydroxide as a main component and a complex oxide of lithium and cobalt as a conductive agent. The lithium-cobalt complex oxide as a conductive agent is preferably represented by the formula Li_xCoO_2 (x is 0.2–0.9).

COMPONENTS AND/OR CHARGERS

6104166

METHOD AND DEVICE FOR DETECTING A STATE OF CHARGE OF A BATTERY ASSEMBLY, AND BATTERY ASSEMBLY CHARGE AND DISCHARGE CONTROL DEVICE

Yoshiaki Kikuchi; Toshiyuki Sekimori; Fumihiko Asakawa; Susumu Ukita; Yoshimi Shoji; Toshiaki Nakanishi; Tadao Kimura; Tomoya Katoh; JAPAN assigned to Toyota Jidosha Kabushiki Kaisha, Matsushita Electric Industrial Company Ltd. and Denso Corporation

Variation of the charged amount among battery blocks composing a battery assembly is detected. By subtracting the detected value of the variation from the width between the upper limit value and the lower limit value of the charged amount, the movable range of the charged amount is found. The position of the present charged amount is detected as the state of charge. For example, it is arranged that both ends of the movable range are 0 and 100%, and that the movable range is the full scale. Then, the position of the charged

amount on this scale is specified by the ratio (%). The detection of the state of charge in which the variation in charged amount and the change of the movable range are considered, is performed, and on the basis of this state of charge, a preferable charge and discharge control is performed.

6118251

BATTERY DEPASSIVATION AND CONDITIONING METHOD AND APPARATUS

Terrill B. Atwater; UNITED STATES assigned to The United States of America as represented by the Secretary of the Army

The present invention provides a unique method for safely and effectively moving the passive layer from the anode of a battery, so that the battery will function safely and properly. Batteries that are stored for long periods of time develop passive layers over their anodes. The present invention removes this passive layer by applying a series of controlled electric pulses to the anode. When a controlled electric charge discharges at the anode, it removes a portion of the passive layer at the discharge region of the anode. Each pulse is separated from a subsequent pulse by a resting time period. This resting period allows the anode to recover, so that the subsequent pulse will discharge at another location. These pulses are applied to the anode until the entire passive layer is safely removed, thus allowing the battery to function properly.

OTHER BATTERIES

6103426

METAL ION BATTERIES HAVING NON-COMPATIBLE ELECTROLYTES AND METHODS OF FABRICATING SAME

Subhash Narang; Susanna Ventura; Philip Cox; UNITED STATES assigned to SRI International

Secondary metal ion batteries are fabricated using a working electrolyte that is substantially incompatible with the anode material. This is accomplished by forming an SEI on the anode material at least in part using a compatible (i.e. SEI developing) electrolyte, and including a substantially incompatible (non-SEI forming) composition as the working electrolyte.

6106978

NON-AQUEOUS ELECTROLYTE SECONDARY CELL

Yoshiaki Takeuchi; JAPAN assigned to Sony Corporation

An improved non-aqueous electrolyte cell according to this invention includes a negative electrode which is a composite sintered body of a carbonaceous sintered material retained on an expanded metal mesh collector. The expanded metal

mesh has a sheet thickness T , a mesh long width center distance LW , a mesh short width center distance SW , a mesh long width maximum opening a ; and a mesh short width maximum opening b , all carefully specified to obey predetermined conditions in order to provide improved secondary cells having high energy density. The expanded metal mesh collector has a specified configuration to prevent carbon layer cracking and/or separation of the carbon layer, caused by shrinkage of the carbon layer on sintering or by expansion/shrinkage of the carbon layer during charging and discharging, to secure stable cell characteristics.

6110619

ELECTROCHEMICAL CELLS WITH CATIONIC POLYMERS AND ELECTROACTIVE SULFUR COMPOUNDS

Shengshui Zhang; Song Cheng; UNITED STATES assigned to Moltech Corporation

The present invention pertains to solid composite cathodes which comprise: (a) an electroactive sulfur-containing cathode material which, in its oxidized state, comprises a polysulfide moiety of the formula: $-S_m-$ where m is an integer from 3 to 10 and (b) a cationic polymer comprising quaternary ammonium salt groups. The present invention also pertains to electric current producing cells comprising such solid composite cathodes, and methods of making such solid composite cathodes and electric current producing cells.

6114059

CYLINDER-SHAPED SECONDARY BATTERY

Goro Watanabe; Kenichi Suzuki; Yoshiaki Ebine; JAPAN assigned to Kabushiki Kaisha Toyota Chuo Kenkyusho

A cylinder-shaped secondary battery includes a container, and a rolled electrode. The container includes a cylinder-shaped inner member, a cylinder-shaped outer member, and a pair of ring-shaped end plates. The electrode is accommodated in the container in an electrically insulating manner, rolled spirally, and has a pair of tabs and a hollow formed therein and extending in an axial direction thereof. Moreover, the electrode includes a positive electrode, a negative electrode and a separator disposed between the positive electrode and negative electrode so as to separate them. The inner member of the container has opposite ends and a hollow formed therein and extending in an axial direction thereof, and is disposed in the axially-extending hollow of the electrode. The outer member of the container has opposite ends, and is disposed on a centrifugal side of the electrode. The end plates of the container close the opposite ends of the inner and outer members, and are pierced through by terminals of the battery in an electrically insulating manner. Moreover, the end plates are bonded to the opposite ends of the inner member and/or the outer member by welding. The thus constructed battery has such good

heat-radiating ability and high pressure resistance that it can stably carry out its functions.

6120707

SECONDARY BATTERY

Takayuki Shirane; Takafumi Fujiwara; Hiroki Muraoka; Shoichiro Watanabe; Shigeo Kobayashi; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

A non-aqueous secondary battery has high energy density and excellent charging and discharging cycle characteristic. The constitution includes: (a) a positive electrode having a positive electrode substance; (b) a negative electrode having an carbon fluoride, and a carbon material and (c) an electrolyte solution. The positive electrode substance is capable of releasing and occluding lithium ions in charging and discharging, the carbon material is capable of occluding and releasing the lithium ions in the charging and discharging, the carbon fluoride is capable of reacting chemically with the lithium ions, and the electrolyte solution is a non-aqueous electrolyte solution. The carbon fluoride is expressed by chemical formula $(C_xF)_n$.

6124057

NON-AQUEOUS ELECTROLYTE SECONDARY BATTERY

Shuji Ito; Toshihide Murata; Yasuhiko Bito; Yoshinori Toyoguchi; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

The present invention provides a non-aqueous electrolyte secondary battery having an anode active material with a high capacity and excellent cycle characteristics. The active material comprises a salt of a metal or a semi-metal and a compound selected from the group consisting of oxo-acids, thiocyanic acid, cyanogen, and cyanic acid, where each said oxo-acid comprises an element selected from the group consisting of nitrogen, sulfur, carbon, boron, phosphorus, selenium, tellurium, tungsten, molybdenum, titanium, chromium, zirconium, niobium, tantalum, manganese, and vanadium, salts of said oxo-acids of phosphorus and boron being restricted to hydrogenphosphates and hydrogenborates.

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**NON-AQUEOUS ELECTROLYTIC SOLUTION,
AND NON-AQUEOUS ELECTROLYTE CELL
COMPRISING IT**

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Disclosed is a non-aqueous electrolytic solution comprising a specific siloxane derivative of the following chemical formula (1) or (2), and at least one light metal salt such as an alkali metal salt; also disclosed is a non-aqueous electrolyte cell comprising the electrolytic solution. The electrolytic solution has good chemical and thermochemical stability, and the cell comprising it has high safety, and has good cell capabilities even at high voltage.