



## ***Patents ALERT***

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***Journal of Power Sources***

**LEAD ACID****6162559****COMPRESSED BATTERY SYSTEM FOR  
MOTIVE POWER APPLICATIONS**

Vutetakis David G.; Cestone Christopher R.; Wilkie Stanley K.; UNITED STATES assigned to Douglas Battery Manufacturing Company

This invention relates to a battery cell housing for valve-regulated, lead-acid batteries. The housing includes a tray base, vertical side walls attached to the base so that the tray base and vertical side walls define a single battery compartment. A top wall is secured to the side walls and has at least one opening. A compression member is positioned in the battery compartment beneath the top wall for movement between the side walls so as to compress a stack of battery cells stacked in a horizontal position in the battery compartment. At least one internally threaded member is included with the top wall and is aligned with at least one opening. At least one compression bolt extends through the top wall opening and contacts the compression member while threadedly engaging at least one internally threaded member.

**6169386****METHOD FOR CHARGING LEAD-ACID  
BATTERY AND CHARGING APPARATUS  
USING THE METHOD**

Okada Yuichi; JAPAN assigned to Japan Storage Battery Company Ltd.

In a method for charging a lead-acid battery having a non-antimony-lead alloy grid, after charging the battery, the battery is incidentally discharged in such a manner that the voltage of said battery which has been incidentally discharged per cell falls below the sum of 70 mV and equilibrium voltage that is an open circuit voltage of the battery in equilibrium state after being fully charged.

**6170559****APPARATUS FOR CASTING A LEAD FORMATION  
ON BATTERY PLATE LUGS**

Barge Christopher Stephen; UNITED KINGDOM assigned to TBS Engineering Ltd.

There is disclosed an apparatus for casting a lead formation, particularly on the lug of a battery component. The lead is streamed over a mould block defining a mould cavity to flood the cavity. The flow of lead is maintained to raise the temperature of the block, at least adjacent the cavity, to achieve an appropriate working temperature.

**FUEL CELL****6156448****HIGH TEMPERATURE FUEL CELL AND HIGH  
TEMPERATURE FUEL CELL STACK**

Greiner Horst; GERMANY assigned to Siemens Aktiengesellschaft

A high temperature fuel cell stack is composed of high temperature fuel cells having interconnecting conducting plates for leading off current produced in the high temperature fuel cell. At least one of the plates is formed of an alloy based on Fe with a Cr content of between 17 and 30 wt.% and has an average coefficient of thermal expansion of between  $13 \times 10^{-6}$  and  $14 \times 10^{-6}$  K in a temperature range from room temperature to 900°C. Two electrodes are disposed between the plates and supplied with a working medium by the plates. One of the electrodes has a thickness of at least 100  $\mu\text{m}$  and the other a thickness of about 30  $\mu\text{m}$ . An electrolyte is disposed between the two electrodes, contains stabilized  $\text{ZrO}_2$  and has a thickness of between 5 and 30  $\mu\text{m}$ . The electrodes and the electrolyte have a coefficient of thermal expansion matched to that of the at least one plate. The material costs for the plates are reduced by a factor of 10–20 in comparison with prior art plates.

**6156449****CATALYST LAYER FOR POLYMER ELECTROLYTE  
FUEL CELLS**

Zuber Ralf; Karch Ralf; Fehl Knut; Starz Karl-Anton; GERMANY assigned to Degussa-Huls Aktiengesellschaft

A catalyst layer on a substrate material which contains a proton-conducting polymer (ionomer), electrically conductive carbon particles and fine particles of at least one precious metal. The catalyst layer is obtainable by coating the substrate material with an ink which contains a dispersion of the carbon particles and at least one organic precious metal complex compound in a solution of the ionomer, and drying the coating below a temperature at which the ionomer or the substrate material is thermally damaged, the precious metals in the complex compounds being present with an oxidation number of 0 and the complex compounds being thermally decomposed during drying to form the fine precious metal particles.

**6159256****METHOD FOR DESULFURIZING A FUEL FOR USE  
IN A FUEL CELL POWER PLANT**

Bonville Jr. Leonard J.; DeGeorge Charles L.; Foley Peter F.; Garow Jay; Lesieur Roger R.; Preston Jr. John L.; Szydowski Donald F.; UNITED STATES assigned to International Fuel Cells LLC

A fuel processing system is operable to remove substantially all of the sulfur present in an undiluted hydrocarbon fuel stock supply used to power a fuel cell power plant in a mobile environment, such as an automobile, bus, truck, boat, or the like, or in a stationary environment. The power plant hydrogen fuel source can be gasoline, diesel fuel, naphtha, light hydrocarbon fuels such as butane, propane, natural gas,

or other like fuels which contain relatively high levels of organic sulfur compounds such as mercaptans, sulfides, disulfides, and the like. The undiluted hydrocarbon fuel supply is passed through a nickel desulfurizer bed wherein essentially all of the sulfur in the organic sulfur compounds react with the nickel reactant, and are converted to nickel sulfide while the desulfurized organic remnants continue through the remainder of the fuel processing system. The system does not require the addition of steam or a hydrogen source to the fuel stream prior to the desulfurizing step. The system operates at relatively low temperatures and can be used to desulfurize either a liquid or a gaseous fuel stream.

**6159533**

**METHOD OF DEPOSITING A CATALYST ON A FUEL CELL ELECTRODE**

Dearnaley Geoffrey; Arps James H.; UNITED STATES assigned to Southwest Research Institute

Fuel cell electrodes comprising a minimal load of catalyst having maximum catalytic activity and a method of forming such fuel cell electrodes. The method comprises vaporizing a catalyst, preferably platinum, in a vacuum to form a catalyst vapor. A catalytically effective amount of the catalyst vapor is deposited onto a carbon catalyst support on the fuel cell electrode. The electrode preferably is carbon cloth. The method reduces the amount of catalyst needed for a high performance fuel cell electrode to about 0.3 mg/cm<sup>2</sup> or less.

**6159626**

**FUEL CELL SYSTEM LOGIC FOR DIFFERENTIATING BETWEEN RAPID AND NORMAL SHUTDOWN COMMANDS**

Keskula Donald H.; Doan Tien M.; Clingerman Bruce J.; UNITED STATES assigned to General Motors Corporation

A method of controlling the operation of a fuel cell system wherein each shutdown command for the system is subjected to decision logic which determines whether the command should be a normal shutdown command or rapid shutdown command. If the logic determines that the shutdown command should be a normal shutdown command, then the system is shutdown in a normal step-by-step process in which the hydrogen stream is consumed within the system. If the logic determines that the shutdown command should be a rapid shutdown command, the hydrogen stream is removed from the system either by dumping to atmosphere or routing to storage.

**6159627**

**BIPOLAR SEPARATOR FOR USE IN A FUEL CELL ASSEMBLY**

Yuh Chao-Yi; Primerano Michael; Farooque Mohammad; UNITED STATES assigned to Energy Research Corporation

A bipolar separator formed from a plate having trough members formed on opposing first and second sides of a central area. Separately formed trough members are secured to opposing third and fourth sides of the central area. The trough members and trough areas are formed so as to reduce stress on the electrolyte matrices supported thereby.

**6162267**

**PROCESS FOR THE GENERATION OF PURE HYDROGEN FOR USE WITH FUEL CELLS**

Priegnitz James W.; Oroskar Anil R.; Stippich Jr. Kenneth J.; Towler Gavin P.; Vanden Bussche Kurt; UNITED STATES assigned to UOP LLC

A process and apparatus are disclosed for the operation of a fuel cell to generate electric power from a feed stream comprising a hydrocarbon or an alcohol. The fuel cell comprises a proton exchange membrane which produces electric power from a hydrogen product stream which comprises essentially no carbon monoxide. The hydrogen product stream is produced from the feed stream in a novel steam reforming zone containing a steam reforming catalyst disposed in a bell-shaped catalyst zone. The bell-shaped catalyst zone is disposed over a combustion zone such that the exhaust gas from the combustion flows around the bell-shaped catalyst zone to heat the catalyst from the inside and the outside of the catalyst zone. Furthermore, the bell-shaped catalyst zone maintains a high inlet and a high outlet temperature to avoid methane slippage in the steam reforming zone. Heat for the steam reforming zone is provided by a fuel stream and at least a portion of the anode waste gas stream from the fuel cell.

**6165632**

**HIGH-TEMPERATURE FUEL CELL AND HIGH-TEMPERATURE FUEL CELL STACK**

Blum Ludger; Fleck Robert; Jansing Thomas; GERMANY assigned to Siemens Aktiengesellschaft

In a high-temperature fuel cell having two components that are joined together by a layer. The layer includes at least one ply of a glass solder and at least one ply of a glass ceramic. Because of this provision, the components are joined together mechanically and chemically in a stable and economic manner.

**6165633**

**METHOD OF AND APPARATUS FOR REFORMING FUEL AND FUEL CELL SYSTEM WITH FUEL-REFORMING APPARATUS INCORPORATED THEREIN**

Negishi Yoshimasa; JAPAN assigned to Toyota Jidosha Kabushiki Kaisha

Methanol supplied as a raw fuel is mixed with water, vaporized in an evaporator, and supplied to a reformer as

a raw fuel gas. The reformer also receives a supply of the compressed air from an air tank. The raw fuel gas is mixed with the compressed air in the reformer. An oxidation reaction of methanol supplied as the raw fuel proceeds in the reformer to generate hydrogen and carbon dioxide, while a steam reforming reaction of methanol simultaneously proceeds in the reformer 22 to generate hydrogen and carbon dioxide. The amount of heat required for the endothermic reforming reaction can be supplied by the oxidation reaction of methanol. No external heat source is accordingly required in the reformer to supply the heat required for the reforming reaction.

#### 6165634

### FUEL CELL WITH IMPROVED SEALING BETWEEN INDIVIDUAL MEMBRANE ASSEMBLIES AND PLATE ASSEMBLIES

Krasij Myron; Moskey Edward A.; UNITED STATES assigned to International Fuel Cells LLC

A fuel cell stack includes a plurality of fuel cells, each of which includes a membrane electrode assembly and a water transport plate, or a fluid flow plate fabricated from graphite. This plate and optionally a separator plate are held in assembled relationship with one another and with the membrane electrode assemblies by a fluoroelastomeric adhesive/sealant that is also coated on the external edges of these components to provide a water-tight seal to better contain the coolant fluid in the form of water provided in the fuel cell stack.

#### 6165635

### Pt/Rh/Fe ALLOY CATALYST FOR FUEL CELLS AND A PROCESS FOR PRODUCING THE SAME

Auer Emmanuel; Heinz Gerhard; Lehmann Thomas; Schwarz Robert; Starz Karl-Anton; GERMANY assigned to Degussa-Huls Aktiengesellschaft

A platinum alloy catalyst on an electrically conductive carbon support which contains an alloy of 40–60 at.% of platinum, 10–20 at.% of rhodium and 20–50 at.% of iron in the form of finely divided alloy particles. The catalyst is characterized in that the average particle size of the alloy particles is less than 10 nm.

#### 6165636

### COMPOSITION OF A SELECTIVE OXIDATION CATALYST FOR USE IN FUEL CELLS

Gaillombardo James R.; De Castro Emory S.; Allen Robert J.; UNITED STATES assigned to De Nora S.p.A.

This invention pertains to improved formulations of platinum–molybdenum alloys for use as anode catalysts. These electrocatalysts find utility as a constituent of gas diffusion electrodes for use in fuel cells that operate at less than 180°C or in applications whereupon hydrogen is oxidized in the

presence of carbon monoxide or other platinum inhibiting substances. The new formulations derive unexpected activity through creating highly dispersed alloy particles of up to approximately 300 Å on carbon supports. The desired activity is achieved by carefully controlling the platinum to molybdenum ratio during preparation and judiciously selecting a proper loading of alloy on the carbon support.

#### 6171718

### PRESSURIZED WATER RECOVERY SYSTEM FOR A FUEL CELL POWER PLANT

Murach Bryan L.; Van Dine Leslie L.; UNITED STATES assigned to International Fuel Cells LLC

The invention is a pressurized water recovery system for a fuel cell power plant including at least one fuel cell having an electrolyte between anode and cathode electrodes for producing an electric current from a reducing fluid and an oxidant stream. A coolant loop directs a coolant fluid from a reservoir through a coolant passage to the fuel cell and back to the reservoir, and the coolant loop also receives coolant fluid through water lines secured between condensing heat exchangers and the coolant reservoir. A process exhaust passage directs a process exhaust stream from adjacent the cathode and anode electrodes out of the fuel cell and into a condensing heat exchanger. Whenever the power plant is under coolant stress, a process exhaust valve selectively directs a portion of the process exhaust stream out of the process exhaust passage to a supercharger that pressurizes the received portion of the process exhaust stream and directs the pressurized portion to a pressurized condensing heat exchanger. Because the process exhaust stream within the pressurized heat exchanger is under pressure, an increased amount of water condenses out of the stream without a need to continuously pressurize any of the fuel cell components. The increased amount of condensed water is directed to the coolant reservoir, and whenever the coolant stress ends, the process exhaust valve and supercharger stop pressurizing any portion of the process exhaust stream.

#### 6171720

### BIPOLAR PLATE/DIFFUSER FOR A PROTON EXCHANGE MEMBRANE FUEL CELL

Besmann Theodore M.; Burchell Timothy D.; UNITED STATES assigned to UT-Battelle LLC

A combination bipolar plate/diffuser fuel cell component includes an electrically conducting solid material having: a porous region having a porous surface; and a hermetic region, the hermetic region defining at least a portion of at least one coolant channel, the porous region defining at least a portion of at least one reactant channel, the porous region defining a flow field medium for diffusing the reactant to the porous surface.

6171721

**SPUTTER-DEPOSITED FUEL CELL MEMBRANES AND ELECTRODES**

Narayanan Sekharipuram R.; Jeffries-Nakamura Barbara; Chun William; Ruiz Ron P.; Valdez Thomas I.; UNITED STATES assigned to California Institute of Technology

A method for preparing a membrane for use in a fuel cell membrane electrode assembly includes the steps of providing an electrolyte membrane, and sputter-depositing a catalyst onto the electrolyte membrane. The sputter-deposited catalyst may be applied to multiple sides of the electrolyte membrane. A method for forming an electrode for use in a fuel cell membrane electrode assembly includes the steps of obtaining a catalyst, obtaining a backing, and sputter-depositing the catalyst onto the backing. The membranes and electrodes are useful for assembling fuel cells that include an anode electrode, a cathode electrode, a fuel supply, and an electrolyte membrane, wherein the electrolyte membrane includes a sputter-deposited catalyst, and the sputter-deposited catalyst is effective for sustaining a voltage across a membrane electrode assembly in the fuel cell.

**BATTERY MATERIALS**

6156184

**POLYMERIC MEMBRANE ELECTROCHEMICAL CELL OPERATING AT TEMPERATURES ABOVE 100°C**

Antonucci Vincenzo; Arico Antonino; ITALY assigned to De Nora S.p.A.

A proton exchange membrane comprising a perfluorosulfonic acid having silica particles embedded therein at a concentration of 0.01–5 wt.%, said particles having a dimension of 0.001–10  $\mu\text{m}$ , the membrane having a crystalline phase and an amorphous phase in a ratio adjusted by controlled thermal treatment at a temperature higher than the glass transition temperature, an electrochemical cell containing said membrane and a process for oxidizing a fuel in said electrochemical cell.

6156454

**POSITIVE ACTIVE MATERIAL FOR ALKALINE ELECTROLYTE STORAGE BATTERY NICKEL ELECTRODES**

Bernard Patrick; Baudry Michelle; FRANCE assigned to Alcatel

A method of manufacturing a positive active material for nickel electrodes of alkaline storage batteries which consists of particles of hydroxide containing mainly nickel and covered with a layer of a hydroxide phase based on nickel and yttrium is disclosed. The proportion of the hydroxide phase is in the range 0.15–3 wt.% of yttrium expressed as yttrium hydroxide relative to the total weight of particles.

6159389

**POLYETHER COPOLYMER AND CROSSLINKED SOLID POLYMER ELECTROLYTE**

Miura Katsuhito; Yanagida Masanori; Higobashi Hiroki; Nakamura Seiji; Japan assigned to Daiso Company Ltd.

A polyether copolymer having a weight-average molecular weight of  $10^4$  to  $10^7$ , comprising 5–40 mol% of a repeating unit derived from epichlorohydrin, 95–60 mol% of a repeating unit derived from ethylene oxide, and 0.001–15 mol% of a crosslinkable repeating unit derived from a reactive oxirane compound, gives a provide a crosslinked solid polymer electrolyte which is superior in processability, moldability, mechanical strength, flexibility and heat resistance, and has markedly improved ionic conductivity.

6159634

**BATTERY SEPARATOR**

Yen William W.; Woodnorth Douglas J.; Cervera James J.; UNITED STATES assigned to Duracell Inc.

A thin separator for batteries is provided. The separator includes a layer that reduces dendrite shorting and a nonwoven layer. Typically, the separator also includes a laminate layer disposed between the nonwoven layer and the layer which reduces dendrite shorting. Additional nonwoven layers can also be included in the separator.

6159638

**SOLID POLYMER ELECTROLYTE AND PREPARATION METHOD THEREFOR**

Takatera Tsutomu; Nishimura Naoto; Mitate Takehito; Minato Kazuaki; JAPAN assigned to Sharp Kabushiki Kaisha

A solid polymer electrolyte having a high ionic conductivity and a high mechanical strength, and a preparation method therefor. The solid polymer electrolyte comprises a metal salt and a polymer blend of a fluoropolymer and a polyether comprising either or both of an ethylene oxide unit and a propylene oxide unit as a monomeric unit.

6159639

**TRIPLE-POLYMER BASED COMPOSITE ELECTROLYTE**

Wen Ten-Chin; Cheng Tsung-Tien; Kuo Han-Cheng, TAIWAN

A WPU(PEG)-WPU(PTMG)-PEO triple-polymer based composite electrolyte is disclosed. The electrolyte includes a thin composite film and an anhydrous liquid electrolyte within the thin film. The thin film is composed of WPU(PTMG) serving as a support, PEO serving as an adsorbent of the liquid electrolytes, and WPU(PEG) serving as a compatibility promoter. On the other hand, the anhydrous liquid electrolyte is used for ionic conduction. The resulting thin film electrolyte has a good conductivity (up

to  $\sim 10^{-2}$  to  $10^{-3}$  S/cm at room temperature), especially within a compositional range of  $\sim 0$ –75 wt.% WPU(PEG),  $\sim 0$ –45 wt.% WPU(PTMG), and  $\sim 20$ –95 wt.% PEO. A WPU(PEG)-WPU(PTMG)-PEO based composite electrolyte is adapted to be used in lithium ion batteries, lithium batteries, and electrochromic devices.

#### 6159858

### SLURRY CONTAINING MANGANESE OXIDE AND A FABRICATION PROCESS OF A SEMICONDUCTOR DEVICE USING SUCH A SLURRY

Kishii Sadahiro; Nakamura Ko; Arimoto Yoshihiro; Hatada Akiyoshi; Suzuki Rintaro; Ueda Naruo; Hanawa Kenzo; JAPAN assigned to Fujitsu Limited, Mitsui Mining and Smelting Company Ltd.

A slurry contains  $MnO_2$  or other manganese oxide as a primary component of abrasive particles. Further, a polishing process using such a manganese oxide abrasive and a fabrication process of a semiconductor device using such a polishing process are disclosed.

#### 6162563

### POLYMER SOLID ELECTROLYTE

Miura Katsuhito; Shoji Shigeru; Sakashita Takahiro; Matoba Yasuo; JAPAN assigned to Daiso Company Ltd.

A polymer solid electrolyte obtained by blending (1) a polyether copolymer having a main chain derived from ethylene oxide and an oligooxyethylene side chain; (2) an electrolyte salt compound; and (3) a plasticizer of an aprotic organic solvent or a derivative or metal salt of a polyalkylene glycol having a number-average molecular weight of 200–5000 or a metal salt of the derivative is superior in ionic conductivity and also superior in processability, moldability and mechanical strength to a conventional solid electrolyte. A secondary battery is constructed by using the polymer solid electrolyte in combination with a lithium metal negative electrode and a lithium cobaltate positive electrode.

#### 6165233

### METHOD OF MAKING ELECTROCHEMICAL CELLS WITH SELF-IMPOSED STACK PRESSURE

Venugopal Ganesh; Louie Edmond; UNITED STATES assigned to Motorola Inc.

A method of fabricating a wound cell that retains its shape includes the steps of employing a heat-shrinkable porous membrane as the cell separator, and heating the cell wind either before or after addition of electrolyte.

#### 6165641

### NANODISPERSE TRANSITION METAL ELECTRODES (NTME) FOR ELECTROCHEMICAL CELLS

Striebel Kathryn A.; Wen Shi-Jie; UNITED STATES assigned to The United States of America as represented by the United States Department of Energy

Disclosed are transition metal electrodes for electrochemical cells using gel-state and solid-state polymers. The electrodes are suitable for use in primary and secondary cells. The electrodes (either negative electrode or positive electrode) are characterized by uniform dispersion of the transition metal at the nanoscale in the polymer. The transition metal moiety is structurally amorphous, so no capacity fade should occur due to lattice expansion/contraction mechanisms. The small grain size, amorphous structure and homogeneous distribution provide improved charge/discharge cycling performance, and a higher initial discharge rate capability. The cells can be cycled at high current densities, limited only by the electrolyte conductivity. A method of making the electrodes (positive and negative), and their usage in electrochemical cells are disclosed.

#### 6166947

### MANGANESE OXIDE MATERIAL HAVING $MnO_3$ AS A MATRIX

Asamitsu Atsushi; Tomioka Yasuhide; Kuwahara Hideki; Tokura Yoshinori; JAPAN assigned to Agency of Industrial Science and Technology Ministry of International Trade and Industry, Angstrom Technology Partnership, Sanyo Electric Company Ltd.

A manganese oxide material has  $MnO_3$  as a matrix. It is an antiferromagnetic insulator and, when subjected to an electrical current or electric field, it is transformed into a ferromagnetic metal.

#### 6168880

### USE OF POLYMER MESH FOR IMPROVEMENT OF SAFETY, PERFORMANCE AND ASSEMBLY OF BATTERIES

Snyder Kent; Liu Wei; Yang Zhen; IRELAND assigned to Valence Technology Inc., General Motors Corporation

The use of a polymer mesh made of material that melts under thermal runaway helps improve the safety of an electrochemical device. The mesh material can increase the impedance of the battery during the thermal runaway and absorb some of the heat produced.

#### 6168889

### BATTERY ELECTROLYTES AND BATTERIES

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

The invention encompasses battery electrolytes and batteries. In one aspect, the invention encompasses a battery electrolyte which includes the lithium salts,  $LiN(CF_3SO_2)_2$ , and  $LiCF_3SO_3$  in a solvent blend comprising ethylene

carbonate, propylene carbonate, and 1,2-dimethoxyethane. In another aspect, the invention encompasses a battery. The battery includes a first electrode, a second electrode, and an electrolyte between the first and second electrodes. The electrolyte comprises these lithium salts in a solvent blend comprising ethylene carbonate, propylene carbonate, and 1,2-dimethoxyethane. In yet another aspect, the invention encompasses another embodiment of a battery. The battery includes a cathode comprising at least one of  $\text{MnO}_2$  and  $(\text{CF})_x$ , and an anode comprising lithium. The battery further includes a non-aqueous electrolyte between the cathode and the anode. The non-aqueous electrolyte comprises the lithium salts in a solvent blend comprising ethylene carbonate, propylene carbonate, and 1,2-dimethoxyethane. The lithium salts comprise a mixture of  $\text{LiN}(\text{CF}_3\text{SO}_2)_2$ , and  $\text{LiCF}_3\text{SO}_3$ .

6171562

**PROCESS FOR THE EXTRACTION AND ELIMINATION OF DELETERIOUS MATERIAL FROM NATURAL MANGANESE DIOXIDE AND CONCENTRATE OF MANGANESE DIOXIDE OBTAINED BY SAID PROCESS**

Paixao Jose Marcio Matta Machado; Amaral Josue Coelho; BRAZIL assigned to Companhia Vale Do Rio Doce

This invention relates to a new process for the extraction and elimination of deleterious material present in natural manganese dioxide (NMD), as well as in natural manganese dioxide obtained by such process. The process involves treating NMD with a HCl and water mixture in a reactor while stirring and heating the mixture. The heating temperature of the reactor is maintained in a predetermined range. The reactor is then fed with an amount of crushed NMD ore. A leaching reaction of said NMD ore with the HCl is produced by leaching for a period of time. Subsequently, the contents of the tank are filtered, washed and dried to recovery the concentrate of manganese dioxide substantially free of deleterious material.

6171725

**NEGATIVE ELECTRODE MATERIAL FOR NON-AQUEOUS SECONDARY BATTERY**

Suzuki Atsushi; Isshiki Nobuyuki; Nakanishi Kuniyuki; JAPAN assigned to Kao Corporation

The present invention relates to a negative electrode material having a great discharge capacity. A non-aqueous secondary battery essentially comprises positive and negative electrodes, the negative electrode material including a negative electrode material containing 30–90 wt.% of silicon and 10–70 wt.% of carbon for the non-aqueous secondary battery, wherein the negative electrode material is obtained by heating silicon or a compound thereof at 600–1500°C under a non-oxidative atmosphere in the coexistence with an organic material carbon material.

6171727

**ALKALINE SECONDARY BATTERY AND METHOD OF MANUFACTURING THE SAME**

Ogura Takao; Tani Atsushi; JAPAN assigned to Canon Kabushiki Kaisha

An alkaline secondary battery comprises a negative electrode made of a hydrogen storing alloy with its surface covered by a layer containing at least carbonate. As method for covering the surface of the hydrogen storing alloy by a layer containing carbonate, carbonate of an alkali metal or an alkaline earth metal may be added to the negative electrode, the positive electrode, the separator or the electrolyte.

**LITHIUM BATTERIES**

6156432

**CARBON MATERIAL FOR NEGATIVE ELECTRODE OF SECONDARY LITHIUM BATTERY, PROCESS FOR PREPARING THE SAME, AND SECONDARY LITHIUM BATTERY PREPARED FROM SAID CARBON MATERIAL**

Mabuchi Akihiro; Fujimoto Hiroyuki; Kasuh Takahiro; Tokumitsu Katsuhisa; JAPAN assigned to Osaka Gas Company Ltd.

In accordance with the present invention, lithium secondary batteries excellent in charge/discharge characteristics, in particular in charge/discharge capacity and initial efficiency, and high in safety can be provided.

6156457

**LITHIUM SECONDARY BATTERY AND METHOD FOR MANUFACTURING A NEGATIVE ELECTRODE**

Takami Norio; Sato Asako; Osaki Takahisa; JAPAN assigned to Kabushiki Kaisha Toshiba

This invention provides a lithium secondary battery comprising a positive electrode, and a negative electrode comprising a carbonaceous material which is capable of absorbing or desorbing lithium ion, wherein the carbonaceous material comprises 1–10 wt.% of boron and 0.1–1 wt.% of oxygen, and has an intensity ratio ( $P_{101}/P_{100}$ ), i.e. a ratio in intensity of a diffraction peak  $P_{101}$  to a (1 0 0) diffraction peak  $P_{100}$  as measured by means of powder X-ray diffraction, of 2 or more.

6159637

**LITHIUM SECONDARY CELL AND POSITIVE ELECTRODE MATERIAL THEREFORE**

Shizuka Kenji; Okahara Kenji; JAPAN assigned to Mitsubishi Chemical Corporation

A positive electrode material for a lithium secondary cell, which contains a spinel-type lithium manganese oxide having a crystal structure belonging to Fd3m (No. 227), wherein the lithium manganese oxide satisfies the following formula: wherein M is at least one metal element substitutable at Mn (16d) sites, other than Mn and Li, A is a halogen atom,  $x$  is from 0.01 to 0.10,  $y$  is a positive number,  $z$  is from 0 to 0.2, and  $\delta$  represents a quantity of oxygen deficiency, and the average valency  $a$  of Mn is from 3.501 to 3.635.

#### 6159640

### ELECTROLYTE SYSTEM FOR LITHIUM BATTERIES AND USE OF SAID SYSTEM, AND METHOD FOR INCREASING THE SAFETY OF LITHIUM BATTERIES

Appel Wolfgang; Pasenok Sergej; GERMANY assigned to Hoechst Research and Technology GmbH and Company KG

Electrolyte systems for lithium batteries of increased safety comprise at least one lithium-containing conducting salt and at least one electrolyte fluid and, according to the invention, are defined by at least one partially fluorinated carbamate of general formula (I) where  $R_1$  and  $R_2$  independently of one another or identical or different, linear  $C_1$ - $C_6$ -alkyl, branched  $C_3$ - $C_6$ -alkyl,  $C_3$ - $C_7$ -cycloalkyl or  $R_1$  and  $R_2$  directly or via one or more additional nitrogen and/or oxygen atoms are linked to form a ring having from three to seven ring members, and the additional nitrogen atoms present in the ring being substituted with  $C_1$ - $C_3$ -alkyl and the ring carbon atoms optionally carrying  $C_1$ - $C_3$ -alkyl, with the option of one or more hydrogen atoms in the radicals  $R_1$  and  $R_2$  being replaced by fluorine atoms,  $R_3$  is a partially fluorinated or perfluorinated straight-chain alkyl group having from one to six carbon atoms, is a partially fluorinated or perfluorinated branched alkyl group having from three to six carbon atoms or a partially fluorinated cycloalkyl group having from three to seven carbon atoms, which optionally be monosubstituted or polysubstituted with  $C_1$ - $C_6$ -alkyl.

#### 6165644

### METHODS AND REAGENTS FOR ENHANCING THE CYCLING EFFICIENCY OF LITHIUM POLYMER BATTERIES

Nimon Yevgeniy S.; Chu May-Ying; Visco Steven J.; UNITED STATES assigned to PolyPlus Battery Company Inc.

Batteries including a lithium electrode and a sulfur counter electrode that demonstrate improved cycling efficiencies are described. In one embodiment, an electrochemical cell having a lithium electrode and a sulfur electrode including at least one of elemental sulfur, lithium sulfide, and a lithium polysulfide is provided. The lithium electrode includes a surface coating that is effective to increase the cycling efficiency of said electrochemical cell. In a more particular embodiment, the lithium electrode is in an electrolyte solution, and, more particularly, an electrolyte solution including

either elemental sulfur, a sulfide, or a polysulfide. In another embodiment, the coating is formed after the lithium electrode is contacted with the electrolyte. In a more particular embodiment, the coating is formed by a reaction between the lithium metal of the lithium electrode and a chemical species present in the electrolyte.

#### 6165645

### POLYMER ELECTROLYTE AND LITHIUM POLYMER BATTERY USING THE SAME

Nishimura Ken; Ogawa Masahiko; Ishida Akiko; Eda Nobuo; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

A gelled polymer electrolyte having a high mechanical strength and a high ion conductivity and a lithium polymer battery using the same electrolyte are disclosed. The gelled polymer electrolyte comprises a polymer alloy and an organic electrolyte solution, wherein the polymer alloy includes a polymer which is hardly soluble in the organic electrolyte solution and another polymer which is soluble in the organic electrolyte solution. The lithium polymer battery comprises a negative electrode including metallic lithium, a lithium alloy, carbon or an inorganic compound, and a positive electrode including an active material of a metal oxide capable of intercalating and deintercalating lithium in a reversible manner, such as  $LiCoO_2$ ,  $LiNiO_2$  or the like, and the gelled polymer electrolyte placed between both electrodes.

#### 6165646

### SOLID STATE RECHARGEABLE LITHIUM BATTERY, STACKING BATTERY, AND CHARGING METHOD OF SAME

Takada Kazunori; Fujino Makoto; Iwamoto Kazuya; Kondo Shigeo; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

A solid-state secondary lithium battery with excellent charge and discharge cycle characteristics, using a negative electrode active material which shows discontinuous change of potential caused by the lithium ion insertion and extraction reactions, wherein the amount of the lithium ion inserted, until discontinuous change of potential of the negative electrode takes place, is equal to or smaller than the maximum amount of extraction of lithium ions within the range where lithium ions are inserted and extracted into or from the lithium transition metal oxide reversibly, and a battery assembly using these batteries.

#### 6168884

### BATTERY WITH AN IN SITU ACTIVATION PLATED LITHIUM ANODE

Neudecker Bernd J.; Dudney Nancy J.; Bates John B.; UNITED STATES assigned to Lockheed Martin Energy Research Corporation



A thin-film rechargeable battery includes a cathode film; including a lithium transition metal oxide, an electrolyte film coupled to the cathode film, the electrolyte film being substantially nonreactive with oxidizing materials and with metallic lithium, an anode current collector coupled to the electrolyte film; and an overlying layer coupled to the anode current collector. The thin-film rechargeable battery is activated during an initial charge by electrochemical plating of a metallic lithium anode between the anode current collector and the electrolyte film. The plating of the anode during charging and the stripping of the anode layer during discharging are essentially reversible. Therefore, almost no diminishment of discharge capacity occurs, even after many discharge and charge cycles. Other advantages include no need for special packaging for shipping and handling. The battery eliminates the main drawbacks of the thin-film Li-ion battery (high capacity loss during the initial charge) and of the thin-film lithium battery (high air-sensitivity at all times, temperature limited to  $\sim 100^\circ\text{C}$ , expensive preparation of the lithium anode). The battery survives processing conditions that exceed those of a solder reflow process without any signs of degradation.

6168887

**LAYERED LITHIUM MANGANESE OXIDE  
BRONZE AND ELECTRODES THEREOF**

Dahn Jeffrey R.; Paulsen Jens M.; CANADA assigned to Chemetals Technology Corporation

This invention relates to layered  $\text{LiMnO}_2$  and  $\text{Li}_x\text{Mn}_{0.82}\text{Company}_{0.18}\text{O}_2$ . They are useful in rechargeable batteries.

6171729

**CONTROL OF SWELLING IN ALKALI METAL  
ELECTROCHEMICAL CELLS**

Gan Hong; Takuchi Esther S.; UNITED STATES assigned to Wilson Greatbatch Ltd.

An alkali metal/solid cathode electrochemical cell, particularly a Li/SVO cell, having an anode-to-cathode (A/C) capacity ratio of  $\sim 0.68$  to  $\sim 0.96$ , is described. This provides the cell with negligible, if any, cell swelling during discharge.

**NICKEL METAL HYDRIDE BATTERIES**

6156455

**METHOD FOR PRODUCING POSITIVE  
ELECTRODES OF ALKALINE STORAGE  
BATTERIES**

Yamamura Yasuharu; Katsumoto Masumi; Kaiya Hideo; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

The present invention provides an alkaline storage battery comprising a positive electrode containing a nickel

hydroxide active material and a compound oxide in a range of 2–30 wt.% to the amount of the nickel hydroxide. The compound oxide contains at least one transition metal element and at least one rare earth element or alkaline earth metal element. The compound oxide has conductivity of  $10^{-2}$  S/cm or higher at  $25^\circ\text{C}$  and stability in an alkaline electrolyte. Consequently, the alkaline storage battery shows excellent characteristics in a long-term preservation at a high temperature, capacity restoration, and charge/discharge cycle life.

6156456

**POSITIVE ELECTRODE ACTIVE MATERIAL  
FOR ALKALINE STORAGE BATTERY**

Izumi Yoichi; Sakamoto Hiroyuki; Izumi Hidekatsu; Matsumoto Isao; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

A positive electrode active material, includes a beta- $\text{Ni}(\text{OH})_2$  type nickel oxide (including hydroxide) containing Mn in the state of solid solution or coprecipitated state with an average valence of Mn being 3.3 valences or more and preferably with a ratio A2/A1 being 1.25 or less which is a ratio of integrated intensity A2 of a peak present at  $2\theta = 18\text{--}21^\circ$  to integrated intensity A1 of a peak present at  $2\theta = 37\text{--}40^\circ$  of powder X-ray diffraction using Cu K $\alpha$  ray.

6163134

**TEMPERATURE COMPENSATION OF THE  
PRESSURE CUTOFF OF CHARGING OF A  
PRESSURIZED-GAS STORAGE BATTERY**

Powers Allen R.; Stadnick Steven J.; UNITED STATES assigned to Hughes Electronics Corporation

A pressurized-gas battery, such as a nickel–hydrogen battery, is rapidly charged at a high charging rate until the measured pressure reaches a high-pressure limit, and thereafter slowly charged at a reduced charging rate as the measured pressure falls toward a low-pressure limit. The high-pressure limit and the low-pressure limit each decrease with increasing temperature.

**COMPONENTS AND/OR CHARGERS**

6172483

**METHOD AND APPARATUS FOR MEASURING  
COMPLEX IMPEDANCE OF CELLS AND  
BATTERIES**

Champlin Keith S.; UNITED STATES

A periodic time-varying current with smallest period  $1/f_1$  excites a cell/battery and provides a timing reference. Linear circuitry produces two signals, one proportional to the excitation current, the other proportional to the responding time-varying voltage. These signals are processed with

identical frequency-limiting filters to attenuate higher-order harmonics and noise. Using the timing reference for synchronization, a microprocessor/microcontroller commands analog to digital converters to sample the frequency-limited current and voltage signals at equally-spaced times over a period and accepts the digitized samples as inputs. The digital samples are averaged over multiple periods and employed to calculate averaged Fourier coefficients of in-phase and quadrature components of frequency-limited current and voltage at frequency  $f_1$ . By numerically combining these Fourier coefficients, the microprocessor/microcontroller determines real and imaginary parts of the cell/battery's complex impedance at frequency  $f_1$ .

### **OTHER BATTERIES**

**6156452**

#### **NON-AQUEOUS ELECTROLYTE SECONDARY CELL**

Kozuki Kiyomi; Uemoto Seiichi; Fujii Takabumi; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

A collector terminal for a non-aqueous electrolyte secondary battery, especially a large-size battery, is provided which is free from breakage when its exterior terminal is fastened with a nut with an excessive torque, superior in electrical conductivity, and high in reliability. The section of the collector terminal forming an exterior terminal and the section where lead plates taken out from the electrode group consist of different types of metals, which are integrated by solid-phase bonding or by vacuum brazing. Among the solid-phase bonding methods, diffusion bonding, explosion pressure welding, and friction bonding are effective.

**6156459**

#### **NONAQUEOUS-ELECTROLYTIC SOLUTION SECONDARY BATTERY**

Negoro Masayuki; Tsukahara Jiro; JAPAN assigned to Fuji Photo Film Company Ltd.

There is disclosed a nonaqueous-electrolytic solution secondary battery that comprises a negative-electrode material, a positive-electrode material, and a nonaqueous electrolytic solution containing a lithium salt, wherein the battery contains an organoboron compound. This nonaqueous-electrolytic solution secondary battery has high capacity and good charge and discharge cycle characteristics.

**6162555**

#### **PARTICLE FEEDING APPARATUS FOR ELECTROCHEMICAL POWER SOURCE AND METHOD OF MAKING SAME**

Gutierrez Bernardo A.; Colborn Jeffrey A.; Smedley Stuart I.; Smedley Kent I.; UNITED STATES assigned to Metallic Power Inc.

A novel fuel particle feeding mechanism that significantly improves operation of a refuelable electrochemical power source is provided. One embodiment of the mechanism provides an input of electrolyte and electrochemically active particles into one or more electrochemical cells through a feed tube. The feed tube has several embodiments that improve the flow of electrolyte and particles, and the even and complete settling of particles into individual cell cavities. Each cell cavity is completely filled, evenly and without clogging when open, and fluid communication between cell cavities is completely cut off when closed, to prevent short-circuiting of the power source during discharge or standby. Means are provided to prevent clogging of the feed tube with fuel particles, to promote complete filling of the cell cavities with fuel, and to prevent fuel particles from prematurely flowing out of the cell cavities. A method of operation is also described.

**6165638**

**ELECTROCHEMICAL CELL HAVING  
MULTIPLATE AND JELLYROLL ELECTRODES  
WITH DIFFERING DISCHARGE RATE REGIONS**  
Spillman David M.; Takeuchi Esther S.; UNITED STATES assigned to Wilson Greatbatch Ltd.

An electrochemical cell comprising a medium rate electrode region intended to be discharged under a substantially constant drain and a high rate electrode region disposed in a jellyroll wound configuration intended to be pulse discharged, is described. Both electrode regions share a common anode and are activated with the same electrolyte.

**6165647**

#### **SECONDARY BATTERY COMPRISING A POLYMERIZABLE MATERIAL IN ITS ELECTROLYTE SOLUTION**

Watanabe Shoichiro; Iwamoto Kazuya; Ueda Atsushi; Nunome Jun; Koshina Hizuru; JAPAN assigned to Matsushita Electric Industrial Company Ltd.

A battery excellent in high temperature storage characteristic is presented. It comprises a positive electrode having a positive electrode active material containing a transition metal complex oxide containing lithium, a negative electrode containing a negative electrode material capable of storing and releasing a lithium ion, and an electrolytic solution containing a nonaqueous solvent, an electrolyte, and an organic compound expressed in formula 1 where  $R_1$ ,  $R_2$ ,  $R_3$ ,  $R_4$ ,  $R_5$ , and  $R_6$  have individually at least one of H and a group containing a vinyl group, and the number of H substituent is four or less.

**6166524**

**ALTERNATE FUEL GAUGE FOR AN ALKALI  
METAL ELECTROCHEMICAL CELL**  
Takeuchi Esther S.; Waite Noelle M.; Syracuse Kenneth C.; UNITED STATES assigned to Wilson Greatbatch Ltd.

A “fuel gauge” for a pulse dischargeable alkali metal/solid cathode cell is described. The rate of voltage recovery is used to determine the state of charge of the cell. Voltage recovery includes recovery from one load to a second, lighter load, or a loaded condition to OCV. The present invention is particularly useful as an end-of-life indicator for a  $\text{Li/CF}_x$  cell powering an implantable medical device.

**6166548**

**METHOD OF DETECTING BATTERY CAPACITY  
IN A ZINC–AIR BATTERY**

Winzer Jochen; Kurple Bill; UNITED STATES assigned to Timex Corporation

A method of detecting battery capacity in a zinc–air battery. The method includes the steps of removing all non-essential loads from the battery for a first period of time, thereafter and for a second period of time, applying a constant load to the battery, periodically sampling the voltage of the battery, and, as a function thereof, determining whether a condition is satisfied during the second period of time, the satisfying of the condition indicating low battery capacity. The method of detecting battery capacity can also determine battery usage on a real-time basis in which an accumulator is loaded with a value representing an expected zinc–air battery capacity, loads on the battery are detected, and the accumulator is decremented based on the detected actual usage. The accumulator reaching a minimum value indicates that the battery capacity is low.

**6168877**

**AIR-MANAGING SYSTEM FOR METAL–AIR  
BATTERY USING RESEALABLE SEPTUM**

Pedicini Christopher S.; Witzigreuter John D.; UNITED STATES assigned to AER Energy Resources Inc.

An air-managing system for metal–air battery includes resealable septum and one or more hollow needles. The septum separates air pathway into two segments. One segment is from air cathodes of the battery to the septum and the other is from the septum to the outside air. The needles provide conduits to connect two segments. The septum re-closes its torn portion when the needles are removed. Also disclosed is a reusable air manager including a fan and such needles. The air manager can be coupled to a disposable cell pack which has a septum that can be pierced by the needles.

**6171719**

**ELECTRODE PLATE STRUCTURES FOR  
HIGH-PRESSURE ELECTROCHEMICAL  
CELL DEVICES**

Roy Robert J.; Critz Kurt M.; Leonida Andrei; UNITED STATES assigned to United Technologies Corporation

An electrochemical cell electrode plate structure, a high-pressure electrochemical cell device, and a method for preparing such devices, are provided. The inventive electrode plate structure comprises a laminar assembly of slotted plate-shaped components that provides more uniform openings or flow passages across the active areas thereof. The inventive high-pressure electrochemical cell device comprises at least one cell made up of both slotted and unslotted plate-shaped components that are free of material deformations typically resulting from the high compressive force employed during final cell assembly. The inventive method for preparing such devices basically involves preparing at least one laminated sub-assembly comprising unslotted component layers for the purpose of consolidating such weaker layers into stronger sub-assemblies prior to a final lamination step.