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LEAD ACID**5879830****PROCESS FOR REGENERATING SODIUM
SULPHIDE FROM THE SODIUM
SULPHATE WHICH FORMS IN
TREATING LEAD PASTE FROM
EXHAUSTED BATTERIES**

Olper Marco; Maccagni Massimo; Cossali Silvano Monza, ITALY assigned to Ecochem Aktiengesellschaft

A process is disclosed for treating lead paste from exhausted batteries. Calcium sulfite and calciumthiosulfite are formed by the reaction: (*See Patent for Tabular Presentation*) $\text{PS The CaS and CaS}_2\text{O}_3$ is reacted with sodium sulfate to effect the double exchange reaction: (*See Patent for Tabular Presentation*) $\text{PS The sodium sulfide and sodiumthiosulfate is then reacted with the lead paste for converting the various lead paste components (PbSO}_4, \text{PbO and PbO}_2) \text{ into PbS with the concomitant production of sodium sulfate. The sodium sulfate can be recycled to reaction (2).}$

5885731**WELDLESS BATTERY USING COVER AS
MOLD TO CAST PLATE STRAPS,
THROUGH THE PARTITION
CONNECTIONS AND TERMINALS**

Shannon Jack; Shannon James M Racine, WI, UNITED STATES assigned to Enersafe Corporation

An improved battery design which utilizes the cover of the container as a mold to simultaneously create a plurality of solid cast electrical circuits, including external terminals, all without welded connections. The battery cover includes a plurality of plate strap mold wells or mold wells which receive molten lead. Adjacent plate strap mold wells are separated by a partition wall. An aperture is formed in the partition wall which allows molten lead to flow between adjacent plate strap mold wells and connect thereof. Terminal mold wells have terminal apertures through which molten lead flows to form an external terminal with the aid of a external terminal mold. A meltable sealant material is pre-applied to the plurality of mold wells and which becomes fluid upon introduction of molten lead. Upon cooling, the sealant material prevents migration of electrolyte between mold wells. The sealant material also prevents electrolyte and gasses from leaking out of the juncture between the external terminals and the battery cover. The sealant material further has the advantage of flowing into the fusion junctures between the plate lugs and the plate straps. The plate lugs may also be pre-coated when bright metal clean with a flux to prevent oxidation and a sealant to retain the flux. The flux retained by the sealant inhibits oxidation of the plate lugs. With this

innovative method of battery manufacture, the battery is assembled and completely sealed in a matter of seconds.

5895732**BATTERY ELEMENT CONTAINING
MACROPOROUS ADDITIVES**

Clough Thomas J Grover Beach, CA, UNITED STATES assigned to Ensci Inc

A battery element of a lead acid battery including a negative plate and a positive plate having a macroporous porosity enhancing additive that improves the utilization efficiency of the battery.

FUEL CELL**5879826****PROTON EXCHANGE MEMBRANE FUEL
CELL**

Lehman Peter; Chamberlin Charles E; Reid Ronald M; Herron Thomas G Arcata, CA, UNITED STATES assigned to Humboldt State University Foundation

A polymer electrolyte membrane fuel cell using hydrogen as the fuel and oxygen containing air as the oxidant. The fuel cell including a hydrogen side electrode; an air side electrode; an electrolyte positioned between the electrodes; a hydrogen diffuser/collector plate including hydrogen channels; and an air diffuser/collector plate including air channels. A method of operation of the fuel cell including introducing hydrogen into the hydrogen channels and introducing air into the air channels at a pressure of less than 5 psig and with a channel velocity of between about 0.15 and 7.0 meters/second.

5897972**MOLTEN CARBONATE FUEL CELL**

Hosaka Minoru Tokyo, JAPAN assigned to Ishikawajima-Harima Heavy Industries Company Ltd

There is provided a molten carbonate fuel cell including (a) fuel electrodes, (b) air electrodes, and (c) electrolytic plates sandwiched between the fuel and air electrodes, and one of each of the fuel electrodes, the air electrodes and the electrolytic plates cooperating with one another to define a unit cell, the electrolytic plate being formed with a plurality of fine through-holes through which the fuel and air electrodes are in fluid communication with each other, both unreacted gas and gas produced by reaction at the fuel electrode flowing from the fuel electrode to the air electrode through the through-holes. The above mentioned

molten carbonate fuel cell provides advantages of no reduction in cell performance which would otherwise be caused by Nernst loss, capability of fuel consumption with high efficiency, no necessity of carbon dioxide gas recycling system, responsibility to rapid fluctuation in load, making a structure of a generating set simpler, and reduction in fabrication costs.

5900329

FUEL-CELL SYSTEM AND METHOD FOR OPERATING A FUEL-CELL SYSTEM

Reiter Kur; Chmelik Pave; Lehmeier Jumlr Erlangen, GERMANY assigned to Siemens Aktiengesellschaft

It is presently customary in a high-temperature fuel-cell system to divide the cathode waste gas, in particular, into two subflows, of which one is recirculated again to the cathode and the other is removed for heat utilization. The bifurcation is carried out at relatively high technical costs at about the operating temperature of the fuel cell at the gas outlets themselves. In order to reduce that cost, the entire cathode waste gas is fed through a heat exchanger to a bifurcation having two branch pipes. The first branch pipe opens through an air addition point and the heat exchanger into the cathode and the second branch pipe opens into a temperature-increasing device. In this way, a bifurcation of the hot cathode waste gas is avoided and the heat of the entire cathode waste gas is used to heat the cathode waste gas subflow fed back into the cathode. The invention can preferably be used, in particular, for fuel cells having operating temperatures above 600 °C Such fuel cells are the molten carbonate fuel cell and the solid electrolyte fuel cell.

5902691

FUEL CELL WITH SHARED SPACE FOR ELECTRODE ASSEMBLY

Matzkin-Bridger Andrew West Bloomfield, MI, UNITED STATES assigned to UT Automotive Dearborn Inc

The invention relates to a fuel cell stack with two separators in which adjacent, but spaced apart, electrode assemblies share either a fuel space or an oxidizer space between them. Each of the electrode assemblies includes a proton exchange membrane sandwiched between an anode and a cathode. A first electrode assembly is positioned apart from one of the separators and oriented with either its anode or its cathode facing that separator. Subsequent electrode assemblies are placed between the first electrode assembly and the other separator. Each subsequent electrode assembly is oriented with the opposite side, anode or cathode, as compared to the immediately preceding elec-

trode assembly, facing these parator that is adjacent the first electrode assembly. Each space that has at least one side defined by an anode is used as a fuel space. Each space that has at least one side defined by a cathode is used as an oxidizer space. Within the stack the anodes and the cathodes of the electrode assemblies are electrically coupled to each other.

5902692

BATTERY WITH PLANAR HIGH TEMPERATURE FUEL CELLS

Batawi Emad Winterthur, SWITZERLAND assigned to Sulzer Hexis AG

The battery with planar high temperature fuel cells comprises a stack-shaped, alternating arrangement of electrochemically active elements and interconnectors. The interconnectors are formed as air heat exchangers, each of which has a basic body. The thermal expansion of the interconnector is largely determined by the basic body. Each basic body separates an air side from a gas side. A structured layer is arranged on both sides of the basic body in each case: namely a structured layer for electrical conduction and heat transport as well as for transport of air or combustion gas respectively along the electrochemically active elements. The thermal expansion of the basic body corresponds substantially to that of the electrochemically active elements. Each basic body is formed as an air heat exchanger and consists of a material on whose surface a permanent oxide layer forms under the operating conditions of the battery and in the presence of oxygen. On the air side of the basic body, the structured layer is bonded to the basic body in such a manner that the basic body is protected against oxide formation at the connection points.

BATTERY MATERIALS

5879417

PROCESS FOR PREPARING CARBON ELECTRODE FOR NONAQUEOUS SECONDARY BATTERY

Yamada Kazuo; Mitate Takehito; Nishimura Naoto; Tsukuda Yoshihiro; Yoneda Tetsuya Nara, JAPAN assigned to Sharp Kabushiki Kaisha

A carbon electrode for a nonaqueous secondary battery is provided, which comprises a metal collector serving to catalyze carbon graphitization, graphite particles, and a carbon material having a lower crystallinity than the graphite particles, the graphite particles and the carbon material being sintered together on the metal collector or in the presence of the metal collector.

5879654**PROCESS FOR PREPARING LITHIUM
INTERCALATION COMPOUNDS**

van Ghemen Max; Sauerbrey Birgi; Pohl Ludwig Darmstadt, GERMANY assigned to Merck Patent Gesellschaft mit Beschränkter Haftung

The invention relates to a process for preparing lithium intercalation compounds by thermal solid state reaction of mixtures of lithium hydroxide or lithium oxide and oxides or oxide precursors of transition metals. A significant step of this process is the treatment of an aqueous suspension of the raw material components lithium hydroxide or lithium oxide and metal oxide or metal oxide precursors with hydrogen peroxide, resulting in the lithium compound going into solution. In the drying of the mixture, the lithium hydroxide is very uniformly absorbed onto the metal oxide. Calcination at temperatures between 450 °C and 700 °C results in complete reaction to form the lithium intercalation compound in less than 5 hours.

5879827**CATALYST FOR MEMBRANE
ELECTRODE ASSEMBLY AND METHOD
OF MAKING**

Debe Mark; Haugen Gregory; Steinbach Andrew; Thomas John; Ziegler Raymond Stillwater, MN, UNITED STATES assigned to Minnesota Mining and Manufacturing Company

Nanostructured elements are provided for use in the electrode of a membrane electrode assembly for use in fuel cells, sensors, electrochemical cells, and the like. The nanostructured elements comprise acicular microstructured support whiskers bearing acicular nanoscopic catalyst particles which may comprise alternating layers of catalyst materials, which may comprise a surface layer that differs in composition from the bulk composition of the catalyst particles, and which may demonstrate improved carbon monoxide tolerance.

5879828**MEMBRANE ELECTRODE ASSEMBLY**

Debe Mark K; Poirier Richard; Wackerfuss Michael K; Ziegler Raymond J Stillwater, MN, UNITED STATES assigned to Minnesota Mining and Manufacturing Company

A membrane electrode assembly is provided comprising an ion conducting membrane and one or more electrode layers that comprise nanostructured elements, wherein the nanostructured elements are in incomplete contact with the ion conducting membrane. This invention also provides methods to make the membrane electrode assembly of the

invention. The membrane electrode assembly of this invention is suitable for use in electrochemical devices, including proton exchange membrane fuel cells, electrolyzers, chlor-alkali separation membranes, and the like.

5882721**PROCESS OF MANUFACTURING
POROUS SEPARATOR FOR
ELECTROCHEMICAL POWER SUPPLY**

Delnick Frank M Dexter, MI, UNITED STATES

A method of forming a porous composite separator layer for an electrochemical cell comprising the steps of printing a thin layer of a separator precursor solution on the surface of one of the electrochemical cell electrodes, curing the thin layer of separator precursor solution so that it transforms into a microporous composite separator structure. In the preferred embodiment, the separator precursor solution is formulated as an ink comprising a silica aerogel filler material dispersed in a solution of polymer binder which is dissolved in a suitable solvent. The process allows the manufacture of thin and flexible composite separators which are conformally bonded to the underlying electrodes.

5882810**ACTIVE LAYER FOR MEMBRANE
ELECTRODE ASSEMBLY**

Mussell Robert; Rehg Timothy J Midland, MI, UNITED STATES assigned to The Dow Chemical Company

Described is a membrane electrode assembly having an ion exchange membrane, and at least two active layers positioned on the same side of the membrane; wherein the active layers containing catalytically-active particles and an ionomer; the average equivalent weights of the ionomers in the layers differ by at least 50; and the active layer positioned closest to the membrane contains the ionomer with the lower average equivalent weight. This membrane electrode assembly, when utilized in a fuel cell, provides a relatively high voltage at a given current density and gas flow rate.

5882820**ANODE FOR NON-AQUEOUS
ELECTROLYTE CELL AND METHOD OF
MANUFACTURING THE SAME**

Matsui Tooru; Takeyama Kenichi; Nakagiri Yasushi; Kawai Tetsuya Fujiidera, JAPAN assigned to Matsushita Electric Industrial Company Ltd

The present invention is directed to the provision of an anode for a non-aqueous electrolyte cell, which is excellent

in rapid charge/discharge characteristics, discharge capacity characteristics at high temperatures, charge/discharge characteristics at low temperatures and shelf life, and thus has high reliability. According to the present invention, a sheet, mainly composed of an alkali metal having a body centered cubic crystal structure as an active material, is pressed from a direction normal to the principal surface thereof, thereby preferentially orienting crystallites so that (100) planes, (110) planes, (211) planes, (310) planes, (321) planes or (222) planes are parallel to the principal surface of the sheet, and the thus pressed sheet is used for the anode.

5882822

**BATTERY ELECTRODE AND METHOD
FOR THE PREPARATION THEREOF**

Iida Tamaki; Kasashima Masaki Ibaraki ken, JAPAN assigned to Shin-Etsu Chemical Company Ltd

Proposed is an improvement in the method for the preparation of a battery electrode consisting of a spongy metal sheet to serve as a substrate having a three-dimensional skeletal structure with intercommunicating open pores and an active material filling the open pores of the skeletal structure of the substrate. While the conventional process comprises the steps of imparting electroconductivity to the surface of the skeleton of a foamed resin sheet, forming a plating layer of a metal on the surface of the foamed resin imparted with conductivity and removing the resin by thermal decomposition to leave the metallic plating layer alone followed by impregnation of the open pores with a pasty active material, the improvement of the invention comprises subjecting the foamed resin sheet, prior to the step of imparting the resin surface with electroconductivity, to a low temperature plasma treatment so as to remove the spiky fragments or dendritic protrusions of the resin on the surface of the skeleton so that the impregnating work of the skeletal space of the spongy metal sheet with a pasty active material is greatly facilitated and the durability of the battery prepared by using the battery electrode is remarkably increased. Further, an additional improvement can be obtained by forming the metallic plating layer on the foamed resin skeleton having a larger thickness in the marginal areas of the foamed resin sheet than in the center area surrounded by the marginal areas.

5885728

FLEXIBLE GRAPHITE COMPOSITE

Mercuri Robert Angelo; Capp Joseph Paul; Gough Jeffrey John Seven Hills, OH, UNITED STATES assigned to UCAR Carbon Technology Corporation

Flexible graphite sheet having embedded ceramic fibers extending from its surfaces into the sheet to increase the

permeability of the sheet to resin which is grooved by mechanical deformation into a shape useful as a flow field plate in fuel cells.

5885732

ONE-PIECE LEAK-PROOF BATTERY

Verhoog Roelo Bordeaux, FRANCE assigned to SAFT

The casing of a leak-proof one-piece battery is made of a material comprising a mixture of at least a matrix based on polypropylene and an alloy of a polyamide and a polypropylene. The ratio of the matrix to the alloy is in the range 0.5 to 6 by weight. The alloy forms elongate arborescent inclusions in the matrix such that, on average, the largest dimension of a segment of the arborescence is at least twenty times the smallest dimension of the segment.

5888430

**GRAPHITE COMPOSITE AND METHOD
FOR PRODUCING THE SAME**

Wakayama Hiroaki; Fukushima Yoshiaki; Mizuno Jirou; Mizutani Uichiro; Fukunaga Toshiharu Aichi, JAPAN assigned to Kabushiki Kaisha Toyota Chuo Kenkyusho

The graphite is a composite between graphite particles and other fine, solid element particles, in which the graphite particles account for at least 40 atomic % and the other element particles have particle sizes of 900 nm or smaller and are dispersed in said graphite particles. The other elements may be Li and Si. Preferably, a part of said other elements forms an intercalation compound with graphite. The composite is suitable for a negative electrode of lithium secondary batteries having large discharging capacity, and as adsorbent materials of adsorbing various substances.

5888658

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

Harada Keizo; Watanabe Kenichi; Yamanaka Shosaku; Hayashi Kiyoshi; Morishita Nobuyasu; Takeshima Hiroki; Kaiya Hideo; Ikoma Munehisa Itami, JAPAN assigned to Sumitomo Electric Industries Ltd; 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 wherein 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.

5888667
SEPARATOR FOR JELLY-ROLL TYPE
ELECTRODE

Cheong Jin Dong; Lee Jong Wook; Kang Byoung Hyun Kyungki do, REPUBLIC OF KOREA assigned to Samsung Display Devices Company Ltd

The unnecessary portion of the separator which prevents the short-circuit between the cathode and the anode. In the center of a cylindrical cell is cut off using cutting apparatus or laser beam to increase the inner space of the cell and the electrolyte, and to have higher cell capacity and lower inner pressure of the can while producing gas.

5888671
NON-AQUEOUS ELECTROLYTE
BATTERY

Yamasaki Mikiya; Nohma Toshiyuki; Nishio Koji; Kusumoto Yasuyuk; Shoji Yoshihiro Hirakata, JAPAN assigned to Sanyo Electric Company Ltd

The present invention is directed to a non-aqueous electrolyte battery comprising an anode, a cathode using a carbon material, and a non-aqueous electrolytic solution, wherein the carbon material obtained by coating a core composed of graphitized carbon in which spacing ($d(002)$) of lattice planes (002) is in the range of 3.35 to 3.39 \AA and the length (L_c) of a crystallite in the direction of the c axis is not less than 1000 \AA with coating graphitized carbon in which spacing ($d(002)$) of lattice planes (002) is more than that in the graphitizing carbon and is in the range of 3.36 to 3.48 \AA , the carbon material obtained by coating a core composed of graphitized carbon in which spacing ($d(002)$) of lattice planes (002) is in the range of 3.35 to 3.39 \AA with a calcined product of an organic substance composed of carbon containing sulfur atoms, or the carbon material composed multi-phase graphitized carbon having two or more crystals respectively different crystallinities in one particle, the length (L_c) of a crystallite in the direction of the c axis in each of the crystals being not less than 10 \AA , are used for the cathode.

5897971
EXTRUDABLE LANTHANUM
MANGANITE PASTE, EXTRUDED
LANTHANUM MANGANITE BODY AND
METHOD OF MANUFACTURING
POROUS SINTERED LANTHANUM
MANGANITE BODY

Araki Kiyoshi; Nishioka Masao Nagoya, JAPAN assigned to NGK Insulators Ltd

For the production of sintered lanthanum manganite bodies, such as tubes for solid oxide fuel cell air electrodes, there is used extrudable lanthanum manganite paste having a pH of not less than 8, of a dried unfired extruded lanthanum manganite body formed of material having a pH, measured by grinding the material and diluting with water, of at least 7.3. Providing alkalinity in such a paste or body reduces crack formation and increases productivity.

5900182
ION-CONDUCTIVE POLYMER
ELECTROLYTE, METHOD FOR
PRODUCING THE SAME AND
CAPACITORS USING THE SAME
ELECTROLYTE

Kanbara Teruhisa; Matsui Tooru; Takeyama Kenichi Ikeda, JAPAN assigned to Matsushita Electric Industrial Company Ltd

An ion-conductive polymer electrolyte having a high ionic conductivity and a high stability in both of physical and chemical properties is disclosed. It comprises a polymer containing at least one monomer selected from the group consisting of a hydroxyalkyl acrylate, a hydroxyalkyl methacrylate and vinylene carbonate as its polymerizable ingredient, and at least one electrolyte salt. An aluminum electrolytic capacitor and an electric double-layer capacitor configured with the electrolyte are also disclosed.

5900183
POLYMER ELECTROLYTE
 Kronfli Esam; Jarvis Christine Ruth Swindon, UNITED KINGDOM assigned to Aea Technology PLC

A polymer electrolyte suitable for use in a lithium ion cell comprises polyvinylidene fluoride (PVdF) combined with a solution of a salt such as lithium perchlorate, in a compatible solvent such as an ethylene carbonate/N-methyl-pyrrolidone mixture. The PVdF is a homopolymer of high molecular weight, with a melt flow index at 230 °C and 10 kg of less than 1.0 g/10 min.

5900334**HYDROGEN OCCLUDING ALLOY**

Wada Masahiro; Takizawa Yoshio Omiya, JAPAN assigned to Mitsubishi Materials Corporation

The present invention provides a hydrogen occluding alloy exhibiting high hydrogen absorption and desorption rates, and excellent initial activation in practical use, and a method of making it. There is provided a hydrogen occluding alloy having a composition comprising, by wt %, 32 to 38% of rare earth elements essentially consisting of La and/or Ce, 0.5 to 3.5% of Al, 0.5 to 10% of Mn, 0.005 to 0.5% of hydrogen, optionally 0.1 to 17% of Co, and the balance being Ni and unavoidable impurities; wherein the alloy has a microstructure characterized in that fine rare earth element hydride is dispersively distributed in a matrix having a CaCu₅-type crystal structure in a ratio of 0.5 to 20% by area. There are also provided electrodes and batteries containing such alloys, and methods of making and using such electrodes and batteries.

5900385

**NICKEL-CONTAINING COMPOUNDS
USEFUL AS ELECTRODES AND METHOD
FOR PREPARING SAME**

Dahn Jeffrey; Zheng Tao Hubley, CANADA assigned to Minnesota Mining and Manufacturing Company

A compound having the formula $\text{Li}_q\text{Cr}_x\text{-yNiyMn}_2\text{-xO}_4 + z$ where $q > \text{or} = 2$, $1.0 < \text{or} = x < \text{or} = 1.25$, $0 < y < 0.9$, and $z > \text{or} = 0$. The invention also features an electrode composition containing this compound and processes for preparing a compound having the formula $\text{Li}_q\text{Cr}_x\text{-yNiyMn}_2\text{-xO}_4 + z$ where $q > \text{or} = 2$, $1.0 < \text{or} = x < \text{or} = 1.25$, $0 < y < 0.9$, and $z > \text{or} = 0$.

5882811

**METHOD FOR RECOVERING LITHIUM
CELL MATERIALS**

Kawakami Soichir Nara, JAPAN assigned to Canon Kabushiki Kaisha

To provide a method for treating nonaqueous solvent type cells, in particular, a method by which lithium cells can be treated and resources can be recovered in safe and in a good efficiency, a method for recovering resources of lithium cells comprises the steps of cutting or boring a lithium cell comprised of at least a negative electrode active material, a separator, a positive electrode active material, an electrolyte solution (electrolytic solution), a collector and a cell casing, in an ignition preventing means; washing the lithium cell thus opened, with an organic solvent to recover the electrolytic solution; reacting lithium with a reacting agent to recover lithium in the form of lithium hydroxide or a lithium salt; carrying out filtration

to recover the separator, the collector and a positive electrode material comprising the positive electrode active material; and carrying out distillation to recover the organic solvent. This makes it possible to safely treat lithium cells having been used up, containing organic solvents and metallic lithium, and efficiently recover these sources. This also makes it easy to recycle lithium cells.

5882818**LITHIUM SECONDARY BATTERY**

Fujimoto Masahisa; Yoshinaga Noriyuki; Ueno Koji; Furukawa Nobuhiro; Nohma Toshiyuki; Takahashi Masatoshi Osaka, JAPAN assigned to Sanyo Electric Company Ltd

Provided is a novel lithium secondary battery including a positive electrode including a compound capable of occluding and discharging lithium, a negative electrode composed mainly of a carbon material which includes a graphite as an only or as a principal component, a separator between the positive electrode and the negative electrode; and an electrolyte solution of an electrolyte solute dissolved in a solvent including at least one specific cyclic compound. The lithium secondary battery has a large capacity, small self-discharge rate and excellent cycle characteristics and high charge-discharge efficiency.

5882821**LITHIUM ION SECONDARY BATTERY**

Miyasaka Tsutomu Kanagawa, JAPAN assigned to Fuji Photo Film Company Ltd

In a lithium ion secondary battery having a positive electrode, a negative electrode, a non-aqueous electrolyte, and a container sealing the electrodes and electrolyte therein, the positive electrode is formed of a positive electrode active material which is produced by electrochemically intercalating a lithium ion into a lithium manganese-metal complex oxide in the container to give a positive electrode active material precursor comprising a lithium manganese-metal complex oxide of which lithium ion content is increased, and then releasing a lithium ion from the positive electrode active material precursor in the container, and the negative electrode is formed of a negative electrode active material which is produced by intercalating the released lithium ion into a negative electrode active material precursor of a metal oxide in the container.

5885544

**LITHIUM COBALTATE BASED POSITIVE
ELECTRODE-ACTIVE MATERIAL FOR
LITHIUM SECONDARY CELL AND
METHOD OF MANUFACTURING SAME**

Yamazaki Nobuyuki; Negishi Kathuyuki Tokyo, JAPAN assigned to Nippon Chemical Industrial Company Ltd

A lithium cobaltate based positive electrode-active material for a lithium secondary cell consisting of lithium cobaltate (LiCoO₂) having 0.5% by weight or less of free cobalt oxide (Co₃O₄). According to the present invention, it is possible to provide a lithium cobaltate based positive electrode-active material which has excellent discharge capacity and capacity holding rate and gives a high energy density, suitable for a lithium secondary cell.

5885733

NON-AQUEOUS SECONDARY LITHIUM BATTERY

Ohsawa Toshiyuki; Kabata Toshiyuki; Kurosawa Yoshiko; Kimura Okitoshi; Fujii Toshishige; Katagiri Nobuo; Hayashi Yoshitak Kawasaki, JAPAN assigned to Ricoh Company Ltd

A non-aqueous secondary lithium battery includes a positive electrode; a negative electrode which including at least one component selected from the group consisting of lithium, a lithium alloy, and a host compound which forms an intercalation compound or complex in combination with lithium; and an electrolytic solution or solid electrolyte containing a silicone compound.

5888463

LI RECLAMATION PROCESS

McLaughlin William; Adams Terry S Anaheim, CA, UNITED STATES assigned to Toxco

Li batteries are cryogenically cooled, comminuted and reacted with water having its pH adjusted with the addition of LiOH. The resulting salts are substantially dewatered and optionally further purified in an electrolytic cell to yield substantially uncontaminated LiOH for reuse.

5888670

LITHIUM SECONDARY BATTERY AND ELECTRODES THEREFOR AND METHOD OF FORMING THE SAME

Kawakami Soichir Nara, JAPAN assigned to Canon Kabushiki Kaisha

The present invention provides a lithium secondary battery which has an anode, a separator, a cathode and an electrolyte and which employs intercalation and deintercalation reaction of lithium ions. The anode and/or the cathode of the secondary battery contains a carbonaceous material having a structure in which pores are oriented. The lithium secondary battery exhibits a high charge-discharge efficiency, a high energy density and a long cycle life. The present invention also provides a method of forming the lithium secondary battery including the carbonaceous material having oriented pores, by using an orienting material.

5891416

LITHIUM COBALTATE BASED POSITIVE ELECTRODE-ACTIVE MATERIAL FOR LITHIUM SECONDARY CELL AND METHOD OF MANUFACTURING SAME

Yamazaki Nobuyuk; Negishi Kathuyuk Tokyo, JAPAN assigned to Nippon Chemical Industrial Company Ltd

A lithium cobaltate based positive electrode-active material for a lithium secondary cell consisting of lithium cobaltate (LiCoO₂) powder having particle properties of an n-value of at least 2.0 in Rosine-Rammler's distribution (R- lambda). According to the present invention, it is possible to provide a lithium cobaltate based positive electrode-active material which is excellent in discharge capacity and capacity holding rate and gives high energy density, suitable for a lithium secondary cell.

5891588

LITHIUM SECONDARY BATTERY

Sakai Shigeru; Yamamoto Masahir Iwaki, JAPAN assigned to Furukawa Denchi Kabushiki Kaisha

A lithium secondary battery including a negative electrode having has been inserted an active material at least one member selected from the group of metallic lithium, lithium alloys and materials which are capable of electrochemically occluding and releasing lithium ions; a positive electrode having an active material consisting of at least one compound which is capable of electrochemically occluding and releasing lithium ions; and an organic electrolyte. The solvent for the organic electrolyte is composed mainly of a mixture solvent prepared by mixing an organic solvent indicated by Formula I, 4-trifluoromethyl-1, 3-dioxolane-2-one, and one or two selected from the group of organic solvents indicated by Formula II, 1-trifluoroethylmethyl carbonate, and an organic solvent indicated by Formula III, di-1-trifluorethyl carbonate, as mentioned below. As a result of using the solvent which contains the above-mentioned mixture solvent as a main component for the electrolyte, a lithium secondary battery with improved high-rate discharge characteristics, cycle characteristics and safety characteristics is obtained. (*See Patent for Chemical Structure*) FORMULA I (*See Patent for Chemical Structure*) FORMULA II (*See Patent for Chemical Structure*) FORMULA III

5891592

ADDITIVES FOR IMPROVING CYCLE LIFE OF NON-AQUEOUS RECHARGEABLE LITHIUM BATTERIES

Mao Huanyu; Sacken Ulrich Von; Reimers Jan Naess Burnaby, CANADA assigned to NEC Moli Energy (Canada) Limited

The loss in delivered capacity (fade) after cycling non-aqueous rechargeable lithium batteries can be reduced by incorporating a small amount of certain additive compounds in the battery. The additive compound comprises boron, oxygen, and organic end groups that are chemically compatible with the battery components. The structure of the additive compound contains a boroxine (BO)₃ ring. The invention is particularly suited to lithium ion batteries. Trimethoxyboroxine and trimethylboroxin are particularly effective additives. Preferably, the additive compound is dissolved in the electrolyte.

5891593

ELECTRODE MATERIALS SUITABLE FOR LITHIUM-ION ELECTROCHEMICAL CELLS

Keller Harald; Bronstert Bernd; Steininger Helmut; Heil-Guml unter; Blum Raine Ludwigshafen, GERMANY assigned to EMTEC Magnetics GmbH

Electrode materials suitable for electrochemical cells containing a) a polymeric binder which is composed essentially of polyisobutene having a limiting viscosity number of from 551 to 661 g/cm³ and b) a solid which is capable of reversibly taking up or releasing lithium ions in an electrochemical reaction.

5895730

HIGH TEMPERATURE BATTERY

Ritchie Andrew Graha Gosport, UNITED KINGDOM assigned to Secretary of State for Defense The Defence Evaluation and Research Agency

PCT No. PCT/GB95/02140 Sec. 371 Date Mar. 26, 1997 Sec. 102(e) Date Mar. 26, 1997 PCT Filed Sep. 11, 1995 PCT Pub. No. WO96/08845 PCT Pub. Date Mar. 21, 1996. An electrolyte system suitable for a molten salt electrolyte high temperature battery is described consisting only of a first component which consists of one or more lithium halides and a second component which consists of one or more lithium compounds which are not lithium halides, and is preferably one or more of lithium sulphate, lithium sulphide, lithium metaborate and lithium oxide. A molten salt electrolyte high temperature battery is described incorporating the electrolyte, an anode, preferably of lithium or a lithium alloy, and a cathode, preferably of iron disulphide.

5895731

THIN-FILM LITHIUM BATTERY AND PROCESS

Clingempeel Richard K Lanexa, VA, UNITED STATES assigned to Smith Nelson E

A lithium battery and process of making same involves employing alternate layers of a lithium anode and an

aluminum foil or NiAl expanded metal supported cathode assembly with a gel electrolyte contacting the alternate layers. The electrolyte includes a quantity of N-methyl-2-pyrrolidone and lithium contained within a polyimide matrix and the entire assembly is contained within a sealed polyimide casing. Separate electrical contacts are provided for each of the lithium anode assembly and the aluminum foil or NiAl supported cathode assembly. An out-gassing vent tube extends from the sealed polyimide casing and is sealed a predetermined time after battery construction.

5900335

NON-AQUEOUS SECONDARY BATTERY AND NEGATIVE ELECTRODE FOR NON-AQUEOUS SECONDARY BATTERY

Nishimura Naoto; Mitate Takehito; Yoneda Tetsuya; Yamada Kazuo Kitakatsuragi gun, JAPAN assigned to Sharp Kabushiki Kaisha

A non-aqueous secondary battery composed of a negative electrode comprising a carbon material capable of conducting absorption-desorption or intercalation-deintercalation of lithium into or from itself, a positive electrode comprising lithium-containing chalcogenide compound, and a non-aqueous ion conductor, in which the carbon material for the negative electrode is such that combined oxygens on its surface are substantially removed.

5900336

NEGATIVE ELECTRODE FOR LITHIUM SECONDARY BATTERY AND LITHIUM SECONDARY BATTERY USING THE NEGATIVE ELECTRODE

Kabata Toshiyuki; Kurosawa Yoshiko; Ohsawa Toshiyuki; Katagiri Nobuo; Kimura Okitoshi; Fujii Toshishige; Hayashi Yoshitaka; Iechi Hiroyuki; Suzuki Yumiko; Inoue Tomohiro Yokohama, JAPAN assigned to Ricoh Company Ltd

A negative electrode for a lithium secondary battery includes at least two kinds of carbon materials with a spacing of lattice plane (d₀₀₂) of 3.4 Å or less in the direction of the C axis thereof. A lithium secondary battery using this negative electrode is provided.

NICKEL METAL HYDRIDE BATTERIES

5879831

MECHANICAL AND THERMAL IMPROVEMENTS IN METAL HYDRIDE BATTERIES, BATTERY MODULES AND BATTERY PACKS

Ovshinsky Stanford R; Corrigan Dennis A; Venkatesan Srinivasan; Dhar Subhash K; Holland Arthur; Fillmore-Donn; Higley Lin; Gow Philippe; Himmler Ronald; Karditsas Nick; Laming Kenneth; Osgood Anthony

Bloomfield Hills, MI, UNITED STATES assigned to Ovonic Battery Company Inc

Mechanically and thermally improved rechargeable batteries, modules and fluid-cooled battery pack systems. The battery is prismatic in shape with an optimized thickness to width to height aspect ratio which provides the battery with balanced optimal properties when compared with prismatic batteries lacking this optimized aspect ratio. The optimized thickness, width and height allow for maximum capacity and power output, while eliminating deleterious side effects. The battery case design allows for unidirectional expansion which is readily compensated for by applying external mechanical compression counter to that direction. In the module, the batteries are bound within a module bundling/compression means under external mechanical compression which is optimized to balance outward pressure due to expansion and provide additional inward compression to reduce the distance between the positive and negative electrodes, thereby increasing overall battery power. The fluid-cooled battery pack includes; 1) a battery-pack case having coolant inlet and outlet; 2) battery modules within the case such that the battery module is spaced from the case walls and from other battery modules to form coolant flow channels along at least one surface of the bundled batteries; and 3) at least one coolant transport means. The width of the coolant flow channels allows for maximum heat transfer. Finally the batteries, modules and packs can also include means for providing variable thermal insulation to at least that portion of the rechargeable battery system which is most directly exposed to said ambient thermal condition, so as to maintain the temperature of the rechargeable battery system within the desired operating range thereof under-variable ambient conditions.

5879835

**METHOD OF MANUFACTURING
NICKELOUS POSITIVE-ELECTRODE
ACTIVE MATERIAL FOR ALKALINE
BATTERY**

Kawase Hiroshi; Kondo Yasuhito; Morishita Shinya; Towata Shin-ichi Kariya, JAPAN assigned to Kabushiki Kaisha Toyoda Jidoshokki Seisakusho

A method of manufacturing a nickelous positive-electrode active material for an alkaline battery has a formation process in which nickel hydroxide and cobalt hydroxide are formed by adding an alkali metalhydroxide to a reaction system containing nickel ions and cobalt (II) ions. The method comprises at least one step of removing any oxidant which oxidizes the cobalt (II) ions into cobalt (III) ions, during or before the formation process. An expedient for the removal of the oxidant is, for example, to reduce and remove the oxidant by adding a reductant, such as L-ascorbic acid, to the reaction system. The reductant

should preferably have an oxidation potential which is lower than the reduction potential of oxygen. Besides, the method should preferably comprise the step of removing the cobalt (III) ions, during or before the formation process.

COMPONENTS AND / OR CHARGERS

5882812

**OVERCHARGE PROTECTION SYSTEMS
FOR RECHARGEABLE BATTERIES**

Visco Steven J; Chu May-Ying; De Jonghe Lutgard C Berkeley, CA, UNITED STATES assigned to Polyplus Battery Company Inc

Disclosed is an electrochemical device having a shuttle-type redox mechanism for overcharge protection in which the redox reaction is tuned with a tuning agent to adjust the potential at which the redox reaction occurs. Such device may be characterized as including the following elements: (1) a negative electrode (e.g., lithium); (2) a positive electrode containing one or more intermediate species (e.g., polysulfides) which are oxidized to one more oxidized species during overcharge; and (3) a tuning species (e.g., an organosulfur compound) which adjusts the rate at which the oxidized species are reduced and thereby adjusts the voltage at which overcharge protection is provided. The oxidized species produced during overcharge move to the negative electrode where they are reduced back to said intermediate species as in a normal redox shuttle. However, the oxidized species react more rapidly than the intermediate species at the negative electrode. Thus, the overcharge protection mechanism becomes more active as the oxidized species' concentration increases-as occurs during more severe overcharge.

5886527

**METHOD AND DEVICE FOR
MONITORING DETERIORATION OF
BATTERY**

Ito Masaki Iwata, JAPAN assigned to Yamaha Hatsudoki Kabushiki Kaisha

PCT No. PCT/JP97/00169 Sec. 371 Date Sep. 9, 1997 Sec. 102(e) Date Sep. 9, 1997 PCT Filed Jan. 27, 1997 PCT Pub. No. WO97/27495 PCT Pub. Date Jul. 31, 1997. This invention makes it possible to inform a user of a battery replacement timing and a necessity for maintenance by storing in advance a reference value of average battery temperature rise speed, obtaining an actual value of average battery temperature rise speed by measuring the battery temperature during charging, determining the battery deterioration easily, reliably, and irrespective of ambient temperatures at which the battery is charged and discharged by comparing the actual value of average bat-

tery temperature rise speed with the reference vale of average battery temperature rise speed.

5889382
CHARGING DEVICE FOR COMMONLY
CHARGING VARIOUS KINDS OF
BATTERY

Jung Yeon-Ta Kyungki do, REPUBLIC OF KOREA assigned to Samsung Electronics Company Ltd

A charging device for commonly charging various kinds of batteries is provided. The charging device includes a switching portion controlled to interrupt the supply of power to the charging device and a plurality of charging-paths located between a charging power supply port and the battery's charging port, corresponding to the kinds of battery. A charging voltage detector detects a predetermined voltage or current formed when connected to the first sensing resistor of a battery assembly in order to detect the charged voltage of the battery and a capacity detector detects a predetermined voltage or current formed when connected to the second sensing resistor of the battery assembly in order to detect the charged capacity of the battery. A main controller determines the kind of battery and selects a corresponding charging path according to the voltage and current value respectively detected from the charging voltage detector and capacity detector so as to allow the selected charging path to be connected to the battery's charging port.

5889383
SYSTEM AND METHOD FOR CHARGING
BATTERIES WITH AMBIENT ACOUSTIC
ENERGY

Teich Paul Austin, TX, UNITED STATES assigned to Advanced Micro Devices Inc

A system and method for charging rechargeable batteries using power from ambient acoustic waves. A first embodiment comprises a system with one or more audio speakers and a battery charger. Each speaker has a transducer that generates an electromotive force (EMF) in response to acoustic waves incident on the speaker. The battery charger receives the EMF from the speaker and charges one or more batteries using the received EMF. A second embodiment comprises a method for charging rechargeable batteries by the steps of generating a sound wave incident on an audiospeaker, the speaker generating an EMF, providing the EMF to a battery charger, and the battery charger using the EMF to charge the batteries. A third embodiment-comprises a battery charger that uses electrical power generated by one or more audio speakers to charge one or more rechargeable batteries. A rectifying unit in the battery charger receives and rectifies EMFs from the speakers and provides it to the batteries. In a fourth embodiment, the

invention comprises a portabledtelephone, preferably a cordless telephone or a cellular telephone, with a battery charger that uses acousticenergy incident on the speaker of the portable telephone to charge batteries in the telephone. A fifth embodiment of the present invention comprises a portable electronic device, such as a portable radio, a tape recorder, or a hand-held video game, that uses acoustic energy incident on a speaker or microphone to charge batteries in the portable electronic device.

5889385
EQUALIZATION OF
SERIES-CONNECTED CELLS OF A
BATTERY USING CONTROLLED
CHARGING AND DISCHARGING PULSES

Podrazhansky Yury M; Podrazhansky Mikhail M; Kusharskiy Yefim Alpharetta, GA, UNITED STATES assigned to Advanced Charger Technology Inc

A charge pulse (200A) is applied to the battery (B). The open circuit voltage of each cell (C1-CN) is then measured during a first rest period (210A). A depolarization pulse (220A) is then applied to the battery. The open circuit voltage of each cell is then measured during a second rest period (210B). The open circuit voltages for the first and second rest periods foreach cell are compared to yield a voltage difference (DELTA Y). This voltage difference is then compared with a threshold voltage (V THRESHOLD). If the voltage difference is greater than the threshold voltage then the cell is being charged too rapidly, or is being overcharged, so one or more of the charge cycle parameters are adjusted. Some of the charge cycle parameters are, for example, the charge pulse current amplitude, the charge pulse duration, the number of consecutive charge pulses, the depolarization pulsecurrent amplitude, the depolarization pulse duration, the number of consecutive depolarization pulses, the duration of the rest periods, or a combination of these. Multiple charge pulses (200A, 200B) and depolarization pulses (220A, 220B, 220C) may also be used. These parameters may be adjusted for the battery as a whole and/or for each cell individually. The adjustment to the charge cycle parameters may also be made on a worst case or a best case cell basis, with this cell controlling the charge cycle parameters for all the cells. Several-techniques for adjusting the charge cycle parameters are-disclosed.

5891590
BATTERY RECONDITIONING DEVICE
King Thomas J R Lakefield, Ontario, CANADA

A device and method for reducing crystal formations, which have a range of resonant frequencies, on electrode plates of an electrical battery, is described. A signal generator is connected to the primary winding of a transformer, having primary and secondary windings, so as to deliver a

transformed alternating current signal to the secondary winding. A rectifier is connected to the secondary winding to convert the transformed signal to a train of direct current pulses at a frequency within the range of resonant frequencies, and an output circuit is connected to the rectifier to deliver the train of pulses to the battery causing the crystals to crack and redissolve into the battery solution. There is also a provision for adjusting the frequency of the alternating current signal.

5897973

LITHIUM CELL RECHARGING

Stephenson Andrew David Hamilton; Palmore Sean Francis Steventon, UNITED KINGDOM assigned to AEA Technology

Excessive charging of the weaker cells in a battery of lithium cells, during potentiostatic charging, is prevented by providing each cell (S) with a bypass circuit (12) including a MOSFET (T). An integrated circuit (Y) monitors the cell voltage, and if the design voltage of the cell (S) is exceeded the circuit (Y) provides a signal to the gate of the MOSFET (T) so that part of the charging current (I) bypasses that cell (S), while most of the charging current flows through the cell (S). The bypass current flows only while each of the other cells in the battery are coming up to the design voltage, so that little power is dissipated in the bypass circuit. If the cells are balanced, so they accept charge equally, then the bypass circuit never carries current; if the cells are not balanced, they will be brought near to balance over a few charge/discharge cycles.

5898292

**PROCESS FOR EVALUATING
REMAINING CAPACITY OF BATTERY**

Takemoto Hideharu; Umeyama Hiroya; Watanabe Kenji Saitama, JAPAN assigned to Honda Giken Kogyo Kabushiki Kaisha.

A process for evaluating a remaining capacity of a battery includes the steps of measuring a discharge current and output voltage from the battery during discharging of the battery, calculating a maximum output value of the battery based on a characteristic of the variation in discharge current and output voltage determined from the measured values of the discharge current and output voltage, and evaluating the remaining capacity of the battery based on the calculated maximum output value. The evaluation of the remaining capacity of the battery by this process is prohibited in a sudden-load-varying state in which the variation in load of the battery during discharging of the battery exceeds a predetermined limit level. Thus, it is possible to properly evaluate the remaining capacity of the battery without obtaining or using unstable voltage information of the battery immediately after the load varies

suddenly, thereby leading to an enhanced accuracy of evaluation of the remaining capacity.

5898293

**METHOD OF PREVENTING BATTERY
OVER-DISCHARGE AND A BATTERY
PACK WITH A BATTERY OVER-DISCHARGE
PREVENTION CIRCUIT**

Tamai Mikitaka; Negoro Kouji Tsuna gun, JAPAN assigned to Sanyo Electric Company Ltd

The method of preventing battery over-discharge measures battery voltage with a control circuit, and switches an over-discharge protection switch connected in series with the batteries off with the control circuit when battery voltage drops below a minimum set voltage. Once the over-discharge protection switch turns to an off state, the off voltage at the output side of the switch is measured, and the over-discharge protection switch is held in the off state by this off voltage. When battery voltage rises above the minimum set voltage, return of the over-discharge protection switch to the on state is prevented.

5898294

**CONTROL LOOP FOR PULSE CHARGING
LITHIUM ION CELLS**

Gold Sean P Mountain View, CA, UNITED STATES assigned to PolyStor Corporation

Control circuitry is described for regulating charging current from a current source to a battery. The control circuitry includes a switch for transmitting the charging current from the current source to the positive terminal of the battery. A charge pump drives the gate terminal of the switch above the positive terminal voltage. A comparator stage with hysteresis gates the charge pump. A filtering stage senses the battery voltage and drives the comparator stage. The control circuitry controls the average value of the battery voltage by pulse width modulating the charging current.

5898295

**TECHNIQUE FOR AVOIDING
OVERCHARGING A BATTERY**

Patino Joseph; Ford Robert B Pembroke Pines, FL, UNITED STATES assigned to Motorola Inc

By monitoring both charge current and the battery voltage the likelihood of overcharging a battery is reduced. Battery voltage is compared to a predetermined limit and the battery goes into trickle charge if the predetermined limit is exceeded, but now by also determining if a positive delta in charge current has occurred, the charger can trickle charge the battery even if the cutoff voltage is never exceeded.

5900716**BALANCED BATTERY CHARGER**

Collar Stuar; Stratmoen Scott; Sutowski Robert J; Trainor Michael J Algonquin, IL, UNITED STATES assigned to Northrop Grumman Corporation

A balanced battery charger maintains a balanced charge-upon a plurality of battery cells which are connected inseries with one another. The balanced battery changer has a monitoring circuit for determining when an imbalance between the charge upon the battery cells occurs and a charging/discharging circuit for selectively charging and discharging at least a selected one of the battery cells so as to generally balance the charge upon the battery cells. Balancing the charge upon the batterycells substantially enhances the life thereof.

5900717**RECHARGEABLE BATTERY CHARGING CIRCUIT**

Lee Chang-Hum Anyang, REPUBLIC OF KOREA assigned to SamSung Electronics Company Ltd

A rechargeable battery charging circuit comprises a detection circuit for detecting the ambient temperature and a charging current control circuit for controlling the charging current in dependence upon the ambient temperature. The battery charging circuit charges the battery in response to the ambient temperature variations in order to maximize the charging efficiency of the battery at temperatures higher than room temperature.

5900718**BATTERY CHARGER AND METHOD OF CHARGING BATTERIES**

Tsenter Boris Rosswell, GA, UNITED STATES assigned to Total Battery Management

A battery charger and method of charging are chargeable battery which comprises charging the battery with an initial charging current and measuring and comparing the charging temperature to an initial temperature to identify a temperature factor which either identifies a need to lower the current or terminate the charging current. The temperature factor may be a temperature gradient ΔT . The open circuit voltage may be monitored from the beginning or may begin when ΔT is identified. VOCV is plotted with respect to time t elapsed to identify a point or points on the VOCV (t) curve, such as an inflection point in the $dVOCV/dt$ data or a transition point in the d^2VOCV/dt^2 which indicate the onset of overcharge. If the open circuit voltage VOCV of the battery is sampled from the beginning of charging the second order differential information should be ignored until a predetermined temperature gradient is realized. If a point indicating on set of overcharge is not recognized then charging is continued and the steps

above are repeated until a point or points indicating onset of overcharge are identified. As a safeguard against overcharge, the inflection point on $dVOCV/dt$ curve is utilized to indicate onset of overcharge even if the inflection point on the d^2VOCV/dt^2 curve is not identified and the negative slope- $dVOCV/dt$ is utilized to indicate onset of overcharge if the inflection point on the $dVOCV/dt$ data is not identified.

5903136**METHOD FOR CHARGING SECONDARY BATTERIES**

Takahashi Tadash; Funaki Satoru; Miyazaki Hideki; Nishimura Katsunori; Kumashiro Yoshiaki; Takanuma Akihiro Hitachi, JAPAN assigned to Hitachi Ltd

During the charging of a secondary battery, the charging current is maintained, but the value of the current is changed for a short time, and the internal resistance of the battery is calculated from the voltage and the current before and after the changing of the charging current. The charging voltage is determined by adding an extra voltage equivalent to the voltage drop caused by the internal resistance to a designated voltage. Thus, it takes only a short time for stabilizing the voltage when the current is changed, because the charging current is not switched off completely. Therefore, the charging time can be shortened.

OTHER BATTERIES**5882817****BATTERY CELL DESIGN FOR A BIPOLAR RECHARGEABLE BATTERY**

Hall John C; Inenaga Bruce Saratoga, CA, UNITED-STATES assigned to Space Systems/Loral Inc

Plastic hydrophobic material is bonded to a metallic sheet member such that the resulting sandwich structure is impervious to electro chemical delamination. First and second films of the plastic hydrophobic material are applied to opposed surfaces of the metallic sheet member and extend beyond a peripheral edge of the metallic sheet member to form contiguous border portions. A plurality of perforations are formed through the metallic sheet member at locations spaced from its peripheral edge. A resulting sandwich structure of the metallic sheet member and the first and second films are compressed and simultaneously the temperature is raised to the sintering temperature of the hydrophobic film material. The first and second films are caused to melt sufficiently at their interfaces to cause an intermixing of the juxtaposed material thereof throughout the region of the border portions and throughout the regions of the perforations. When the resulting sandwich structure is cooled to room temperature and the films return to the hardened state, they are firmly bonded together in the region of the border to form an integral fringe

which seals the peripheral edge of the metallic sheet member from ambient conditions and throughout the regions of the perforations such that the first and second films, respectively, are drawn firmly into engagement with the metallic sheet member by reason of the differential coefficient of thermal expansion between the metallic sheet member and the hydrophobic film material.

5882819

**SULFIDE-SERIES ELECTRODE
MATERIAL AND SECONDARY BATTERY
WITH HIGH ENERGY DENSITY**

Naoi Katsuhiko; Torikoshi Akihiko; Suzuki Yasuhiro
Tokyo, JAPAN assigned to Yazaki Corporation

An electrode material includes a sulfide compound containing a tetrazole ring as an active substance. These condary battery using such a material provides an extremely high energy density.

5888663

**LONG-LIFE STORAGE BATTERY WITH A
MAGNETIC FIELD SOURCE AND AN
ACID BASED HEAT SOURCE**

Frazier Leland Scott; Hardge Lawrence James Woodland
Hills, CA, UNITED STATES

A long-life battery has an acid based heat source and a magnetic field source to improve the efficiency and life of the battery's ability to deliver an electrical charge. In particular, an open-ended steel insert having two acid containers containing a muriatic-hydrochloric acid mixture heats up an electrolytic solution that flows within the battery. A magnet disposed between the acid containers generates the magnetic field. The battery maybe terminal-less and use insulated leads that extend from the battery. The insulated leads have connectors for coupling to an electrically-powered device.

5888664

**METAL-AIR BATTERY WITH A
REACTANT AIR PATHWAY**

Sieminski Dennis P; Brammer David A; Champion Edward R Atlanta, GA, UNITED STATES assigned to AER Energy Resources Inc

A metal-air battery pack is disclosed for external assembly to a portable electronic device with a battery compartment. The battery pack electrically connects to the electronic device through an existing connector of the device that is located in the battery compartment of the device. Another aspect of the present invention provides a palm rest as part

of a battery for a portable computing device. Another aspect of the invention provides a network of barriers defining an air pathway through a cathode air plenum to efficiently direct air to the air cathodes of the cells of the battery.

5888666

SECONDARY BATTERY

Kawakami Soichiro Nara, JAPAN assigned to Canon Kabushiki Kaisha

A secondary battery includes an anode, a cathode, an electrolyte, and a layer including communicating pores through which ions participating in a battery reaction can move between the anode side and the cathode side and whose sizes can change depending on environment. The electrolyte and the layer are disposed between the anode and the cathode. The battery also includes a battery housing for accommodating these components.

5888672

POLYIMIDE BATTERY

Gustafson Scott D; Antonucci Joseph T Jacksonville, FL,
UNITED STATES

A battery having at least one anode, at least one cathode, and at least one electrolyte disposed between the anode and the cathode is presented. Each anode comprises an anode current collector, a first soluble, amorphous, thermoplastic polyimide; an electronic conductive filler; and an intercalation material. Each cathode comprises a cathode current collector; a second soluble, amorphous, thermoplastic polyimide; an electronic conductive filler; and a metal oxide. Lastly, each electrolyte comprises a third soluble, amorphous, thermoplastic polyimide and a lithium salt. The process for preparing the battery comprises the steps of preparing an anode slurry, a cathode slurry, and an electrolyte solution. Casting a film of the electrolyte solution to form an electrolyte layer. Coating the anode slurry and the cathode slurry on each respective current collector to form an anode and a cathode. Drying the electrolyte layer, the anode and the cathode and assembling the electrolyte layer, anode and cathode to form a battery.

5888673

ORGANIC ELECTROLYTE CELL

Kawasato Takeshi; Hiratsuka Kazuya; Morimoto Takeshi; Tsushima Manabu; Suhara Manabu Yokohama, JAPAN assigned to Asahi Glass Company Ltd

An organic electrolyte cell comprising an organic electrolyte and an anode and/or a cathode of a carbonaceous

material of a heat-treated material of an aromatic condensation polymer having a specific surface area of at least 1,500 m²/g measured by BET method, wherein a solvent in the electrolyte is a mixed solvent containing a chain-like

carbonate of the formula R1OC (double bond)OR2 (wherein R1 and R2 are monovalent organic groups which may be the same or different) and sulfolane or its derivative.



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