



ELSEVIER

Journal of Power Sources 76 (1998) 129–140

JOURNAL OF  
**POWER  
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**FUEL CELL****5741406****SOLID OXIDE FUEL CELLS HAVING DENSE YTTRIA-STABILIZED ZIRCONIA ELECTROLYTE FILMS AND METHOD OF DEPOSITING ELECTROLYTE FILMS**

Barnett Scott Alexander; Tsai Tsepin Evanston, IL, UNITED STATES assigned to Northwestern University

A method of forming a thin dense electrolyte for a SOFC is described.

**5741408****POLYMER ELECTROLYTE MEMBRANE FOR USE IN FUEL CELLS AND ELECTROLYSIS CELLS**

Helmer-Metzmann Freddy; Osan Frank; Schneller Arnold; Ritter Helmut; Ledjeff Konstantin; Nolte Roland; Thorwirth Ralf Mainz, GERMANY assigned to Hoechst Aktiengesellschaft

In order to produce a polymer electrolyte membrane from sulfonated, aromatic polyether ketone, an aromatic polyether ketone of the formula (I) (\*See Patent for Chemical Structure\*) (I) in which Ar is a phenylene ring having p- and/or m-bonds, Ar' is a phenylene, naphthylene, biphenylene, anthrylene or another divalent aromatic unit, X, N and M, independently of one another are 0 or 1, Y is 0, 1, 2 or 3, P is 1, 2, 3 or 4, is sulfonated and the sulfonic acid is isolated. At least 5% of the sulfonic groups in the sulfonic acid are converted into sulfonyl chloride groups, and these are reacted with an amine containing at least one crosslinkable substituent or a further functional group, and unreacted sulfonyl chloride groups are subsequently hydrolyzed. The resultant aromatic sulfonamide is isolated and dissolved in an organic solvent, the solution is converted into a film, and the crosslinkable substituents in the film are then crosslinked. In specific cases, the crosslinkable substituents can be omitted. In this case, sulfonated polyether ketone is converted into a film from solution.

**5741605****SOLID OXIDE FUEL CELL GENERATOR WITH REMOVABLE MODULAR FUEL CELL STACK CONFIGURATIONS**

Gillett James E; Dederer Jeffrey T; Zafred Paolo R; Collie Jeffrey C Greensburg, PA, UNITED STATES assigned to Westinghouse Electric Corporation

A high temperature solid oxide fuel cell generator produces electrical power from oxidation of hydrocarbon fuel gases such as natural gas, or conditioned fuel gases, such as carbon monoxide or hydrogen, with oxidant gases, such as air or oxygen. This electrochemical reaction occurs in a plurality of electrically connected solid oxide fuel cells bundled and arrayed in a unitary modular fuel cell stack disposed in a compartment in the generator container. The use of a unitary modular fuel cell stack in a generator is similar in concept to that of a removable battery. The fuel cell stack is provided in a pre-assembled self-supporting configuration where the fuel cells are mounted to a common structural base having surrounding side walls defining a chamber. Associated generator equipment may also be mounted to the fuel cell stack configuration to be integral therewith, such as a fuel and oxidant supply and distribution systems, fuel reformation systems, fuel cell support systems, combustion, exhaust and spent fuel recirculation systems, and the like. The pre-assembled self-supporting fuel cell stack arrangement allows for easier assembly, installation, maintenance, better structural support and longer life of the fuel cells contained in the fuel cell stack.

**5747184****JOINING ELEMENT ON A LANTHANUM CHROMITE BASE FOR HIGH-TEMPERATURE FUEL CELLS AND HIGH-TEMPERATURE ELECTROLYSIS CELLS**

Kurbjuhn Manfred; Stolten Detlef; Wagner Wolfgang Friedrichshafen, GERMANY assigned to Dornier GmbH

The present invention relates to a self-supporting joining element for planar high-temperature fuel cells for

high-temperature electrolysis cells comprising the material  $\text{La}_{1+\delta}\text{Mg}_x\text{Al}_y\text{Cr}_{1-x-y}\text{O}_{3\pm\epsilon}$  wherein  $0 < \delta \leq 0.1$ ;  $0.02 < x \leq 0.05$ ;  $0 < y \leq 0.25$ ; and  $0 < \epsilon \leq 0.1$ .

**5747185**

**HIGH TEMPERATURE  
ELECTROCHEMICAL CONVERTER FOR  
HYDROCARBON FUELS**

Hsu Michael S Lincoln, MA, UNITED STATES  
assigned to Ztek Corporation

A sulfur-tolerant electrochemical converter having low internal resistance that is capable of directly processing hydrocarbon fuel having a sulfur component of up to about 50 ppm, and in excess of this amount, without suffering permanent structural damage or suffering a significant and/or permanent decrease in overall operating performance. The electrochemical converter is a high temperature fuel cell that has an operating temperature between about 600°C and about 1200°C and is capable of internally vaporizing and/or reforming the hydrocarbon fuel. One or more of the converter constituents, such as the interconnector, the contact surfaces of the interconnector, the fuel electrode, and the oxidizer electrode, is composed of a selected mixture containing chromium oxide and an alkaline metal oxide.

**BATTERY MATERIALS**

**5741472**

**CARBONACEOUS ELECTRODE  
MATERIAL FOR SECONDARY BATTERY**

Sonobe Naohiro; Masuko Jiro; Iwasaki Takao Iwaki,  
JAPAN assigned to Kureha Kagaku Kogyo Kabushiki  
Kaisha

A carbonaceous electrode having improved capacities for doping and dedoping of a cell active substance, such as lithium, and suitable for a non-aqueous solvent-type secondary battery, is constituted by a carbonaceous

material having a specific microtexture. The carbonaceous material is characterized by an average (002)-plane spacing of at least 0.365 nm according to X-ray diffraction method, and also a ratio  $\rho_H/\rho_B$  of at least 1.15 wherein  $\rho_H$  denotes a density measured by using helium gas as a substitution medium and  $\rho_B$  denotes a density measured by using butanol as a substitution medium.

**5742070**

**METHOD FOR PREPARING AN ACTIVE  
SUBSTANCE OF CHEMICAL CELLS**

Hayashi Yasushi; Adachi Norikazu; Kojima Hisanao  
Oobu chi, JAPAN assigned to Nippondenso Co Ltd

A method for preparing an active substance for use in a positive electrode in chemical cells comprising a negative electrode is described. The method comprises preparing a mixed aqueous solution of a water-soluble lithium compound, a water-soluble transition metal compound, and an organic acid selected from the group consisting of organic acids having, in the molecule, at least one carboxyl group and at least one hydroxyl group and organic acids having at least two carboxyl groups, preparing an organic acid complex comprising lithium and a transition metal, and thermally decomposing the complex at temperatures sufficient for the decomposition to obtain the active substance. The complex may be prepared by dehydrating the solution. Alternatively, the complex may be formed by spraying the solution under heating conditions.

**5746781**

**METHOD AND APPARATUS FOR  
PREPARING ELECTROCHEMICAL  
CELLS**

Velasquez David A; Holmes Douglas B; Gogolin E  
Lawrenc Fairfield, CA, UNITED STATES assigned to  
Valence Technology Inc

A method of fabricating electrochemical cells and batteries wherein the successive anode and cathode layers are separated by a polymeric electrolyte layer having a protruding polymer edge around its perimeter

which reduces the likelihood of inadvertent contact between the anode and cathode current collectors is provided. The polymer edge functions as a non-conducting physical barrier positioned between adjacent current collectors. An apparatus for preparing electrochemical cells is also disclosed.

**5746902**

**ELECTROLYTIC MANGANESE DIOXIDE  
AND METHOD OF MANUFACTURING  
THE SAME**

Takehara Hisao; Nakayama Yoshihiro; Shimizugawa Ryoichi; Kishikawa Tsutomu; Murai Takumi; Takahashi Fumiya; Takahashi Koh Chuo ku, JAPAN assigned to Japan Metals & Chemicals Co Ltd

There is provided manganese dioxide to be suitably used for alkaline manganese batteries and manganese batteries to make them excellent both in the initial performance and the storability. There is also provided a method of manufacturing such manganese dioxide. The electrolytic manganese dioxide has a BET specific surface area of less than 30 m<sup>2</sup>/g (preferably less than 27 m<sup>2</sup>/g) and a suspensiveness of less than 50 mg/liter. A method of manufacturing electrolytic manganese dioxide may be a suspension method, wherein manganese oxide is suspended at a rate of 0.01 to 0.2 g/liter in an electrolytic bath containing sulfuric acid at a concentration of 0.4 to 0.55 mol/liter and electrolyzed to produce electrolytic manganese dioxide with an anodic current density of 0.4 to 3.0 A/dm<sup>2</sup> and an electrolytic temperature of 93 degrees to 103°C, the relationship between the anodic current density and the electrolytic temperature being expressed by  $103 > \text{ or } = y > \text{ or } = 1.67x + 92.33$  (where x represents the anodic current density and y represents the electrolytic temperature). Alternatively, a method of manufacturing electrolytic manganese dioxide may be a clarification method, wherein manganese dioxide is electrolyzed in an electrolytic bath containing sulfuric acid at a concentration of 0.3 to 0.45 mol/liter without being suspended therein to produce electrolytic manganese dioxide with an anodic current density of 0.4 to 0.9 A/dm<sup>2</sup> and an electrolytic temperature of 94 degrees to 103°C, the relationship between the anodic current density and the electrolytic temperature being expressed by  $103 > \text{ or } = y > \text{ or } = 10.00x + 90.00$ . In either the suspension method or the clarification method, two or

more than two values may be cyclically used for the anodic current density within the defined range. Still alternatively, the suspension method and the clarification method may be alternately used for electrolysis.

**LITHIUM BATTERIES**

**5743921**

**METHOD OF MAKING A CELL USING A  
LITHIUM-DEACTIVATED CARBON  
ANODE**

Nazri Gholam-Abbas; Howie Blake James Bloomfield Hills, MI, UNITED STATES assigned to General Motors Corporation

A method of making a secondary, cathode-loaded, lithium-ion cell having a carbon anode including the principal step of cathodizing the carbon in a non-aqueous lithium-ion-conducting solution to deactivate the carbon by neutralizing or passivating any active sites therein.

**5744261**

**INSULATING INCLOSURE FOR LITHIUM  
BATTERIES**

Muffoletto Barry C; Kuwik Raymond J Alden, NY, UNITED STATES assigned to Wilson Greatbatch Ltd

A lithium electrochemical cell including an anode and cathode assembly with the anode connected electrically to a conductive cell casing and an insulated cathode conductor extending through a lid at an end of the casing and connected to a cathode lead near the lid and with a first insulating component for insulating the casing from cell components therein and extending along and within the casing from a closed end thereof toward the lid, and which is characterized by a second insulating component for insulating the lid from components in the casing and extending along within the lid and toward the first insulating bag so as to prevent a short circuit between the lid or casing and the cathode assembly caused by formation of lithium clusters in the region between the

lid or casing and the cathode connector. Preferably the second insulating component is in the form of a cup having a relatively thin base portion extending along the lid and a relatively thin wall portion extending from the base along within the casing and toward the first insulating component which also is in the form of a thin-walled cup. The walls of the first and second insulating components preferably meet in overlapping relation. The insulating arrangement is particularly adapted for use in a cell wherein the anode and cathode assembly comprises a plurality of cathode plates with anode sections interposed therebetween.

**5744262**

**STABLE HIGH-VOLTAGE  
ELECTROLYTE FOR LITHIUM  
SECONDARY BATTERY**

Cheng Cheng-Hung; Yao Ching-Yih; Yang Chia-Yu; Shih Sheng-Hua; Kao Tung-Han; Chen Jin-Ming; Hung Weir-Mirn Taipei, CHINA (TAIWAN) assigned to Industrial Technology Research Institute

An organic electrolyte for use in a lithium secondary battery comprising a lithium salt dissolved in an organic solvent mixture is disclosed. The lithium salt can be  $\text{LiClO}_4$ ,  $\text{LiPF}_6$ ,  $\text{LiBF}_4$ ,  $\text{LiCF}_3\text{SO}_3$ ,  $\text{LiAsF}_6$ , or other lithium salt, and the organic solvent mixture contains a carbonate and an acetate. The carbonate is ethylene carbonate, and the acetate can be either methyl acetate or ethyl acetate. The carbonate and the acetate are provided in a ratio of carbonate/acetate ranging from 80/20 to 20/80, or preferably from 40/60 to 60/40, and said lithium salt has a concentration of between 0.6 and 1.5M, or preferably at about 1M. The electrolyte exhibits excellent stability in a lithium secondary battery having a cathode which contains either  $\text{LiCoO}_2$  or  $\text{LiMn}_2\text{O}_4$ , and can withstand charge/discharge voltages of at least as high as 5 V (vs.  $\text{Li/Li}^+$ ), with excellent service life.

**5744264**

**LITHIUM ION ELECTROCHEMICAL  
CELL**

Barker Jeremy Henderson, NV, UNITED STATES assigned to Valence Technology Inc

Non-aqueous solid electrochemical cells with improved performance can be fabricated by employing intercalation based carbon anodes comprising graphitized microbead carbon particles. When employed in a lithium electrochemical cell sufficient cathode material is employed to intercalate the anode active material to attain a specific electrode capacity of greater than about 372 mAh/g. The electrochemical cell has a cycle life of greater than 200 cycles, and has a first cycle capacity loss of only about 10% to 15%.

**5744265**

**LITHIUM CELL HAVING MIXED  
LITHIUM-METAL-CHALCOGENIDE  
CATHODE**

Barker Jeremy; Saidi M Yazid Henderson, NV, UNITED STATES assigned to Valence Technology Inc

The invention provides a new positive electrode active material having increased capacity and a method for operating an electrochemical lithium cell or battery which has the new positive electrode active material composition. The positive electrode comprises first and second lithium-containing active materials which are different from one another. The invention provides the ability to overcome first cycle inefficiency typically observed when using a single lithium-containing metal chalcogenide by adding a small amount of a second lithium-containing metal chalcogenide, preferably lithium copper oxide.

**5747103**

**METHOD AND APPARATUS FOR  
PRINTING LITHIUM PATTERNS ON A  
PRESS**

Mitchell Chauncey T; Good David M; Shadle Mark A; Verschuur Gerrit Lakeland, TN, UNITED STATES assigned to Voxcom Inc

A printing station conveys a supply of molten lithium from a heated tank to a nozzle within a protective shroud. A web traverses a chiller also within the shroud. The nozzle dispenses discrete amounts of the molten lithium onto successive portions of the web in contact

with the chiller. The chilled lithium solidifies into solid lithium patterns. A sealer also within the shroud prevents exposure of the solid lithium patterns to ambient air. The station can be incorporated into an in-line press for forming a succession of electrochemical cells.

**5747187**

**LITHIUM BATTERY HAVING AN  
OVER-LOADING PREVENTING DEVICE**

Byon Sung Kwang Seoul, assigned to Daewoo Electronics Co Ltd

A lithium battery is provided which can promptly cut off current when it is being overheated by a short or the like, thereby preventing an explosion thereof. A shape-memory alloy spring made of a nickel-titanium alloy is included between the cover and the cap, either for making contact with both the cover and the cap, thereby electrically connecting the cover with the cap, or for separating from the cap in the case of an overheating of the battery, thereby electrically disconnecting the cover from the cap. A semi-spherical protrusion is formed at the center of the spring so as to make contact with the bottom of the cap, so that if the battery is overheated, the protrusion becomes flat, and is separated from the cap, thereby electrically disconnecting the cap from the cover. The semi-spherical protrusion of the shape-memory alloy spring repeatedly contracts and expands so as to prevent the overheating of the battery.

**5747188**

**BATTERY WITH IMPROVED SAFETY  
DURING MECHANICAL ABUSE**

Von Sacken Ulrich; Chow Wendy; Shkuratoff Allen Coquitlam, CANADA assigned to Moli Energy (1990) Limited

A battery construction is disclosed having improved safety behaviour under conditions of mechanical abuse, in particular crush type abuse, wherein an additional site for internal short circuiting is engineered therein. In certain circumstances, it can be beneficial to initiate the engineered short before other internal shorts occur.

Additionally, it may be beneficial for the engineered short to have a lower resistance than the internal resistance of the battery. The invention is particularly suited for application in lithium ion type batteries.

**5747193**

**PROCESS FOR SYNTHESIZING  
LIXMNYO<sub>4</sub> INTERCALATION  
COMPOUNDS**

Gerard Bernar; Larcher Dominique; Tarascon Jean-Marie Amiens, FRANCE assigned to Bell Communications Research Inc

A novel process for making  $\text{Li}_x\text{MnyO}_4$  intercalation compounds, wherein  $0 < x < 2$  and  $1.7 < y < 2$ , comprises the steps of: (1) synthesizing a lithiated manganese oxide precursor by reacting lithium hydroxide, manganese dioxide, and one or more polyhydric alcohols; and (2) heat-treating the lithiated manganese oxide precursor. The intercalation compounds are effectively employed as active components of positive electrodes in rechargeable lithiated intercalation battery cells.

**5747194**

**USE OF A STABLE FORM OF  $\text{LiMnO}_2$  AS  
CATHODE IN LITHIUM CELL**

Davidson Isobel J; McMillan Roderick S; Murray John J Orleans, CANADA assigned to National Research Council of Canada

The invention disclosed relates to a new method of forming spinel-related  $\lambda\text{-Li}_{2-x}\text{Mn}_2\text{O}_4$ , wherein  $0 < x < 2$ , solely by electrochemical means with air-stable orthorhombic  $\text{LiMnO}_2$  as the starting material. This spinel-related material is hygroscopic, metastable and is typically made by chemical means, followed by electrochemical conversion of spinel-type  $\text{LiMn}_2\text{O}_4$ . Also disclosed are new secondary lithium ion electrochemical cells employing as initial active cathode material a compound of formula  $\text{LiMnO}_2$ , having a specific orthorhombic crystal structure.

**5747968****LITHIUM POLYMER BATTERY  
CHARGER APPARATUS**

Merritt Lauren V; Teofilo Vincent L; Hollandsworth Roger Paul; Rodriguez Zaid B; Lovgren Jack Sunnyvale, CA, UNITED STATES assigned to Lockheed Martin Corp Missiles & Space

Lithium polymer battery charger apparatus for charging a plurality of equal charge point lithium polymer battery cells prevent overcharging of any cell, whether the cells are arranged in a series stack or are arranged in parallel. When the cells are connected in a series stack, a power supply is connected to the series stack to apply a charge current to the series stack. The state of charge of each cell in the stack is monitored. Information that the state of charge of any cell is approaching full charge is used to control the charge current and to prevent overcharging of any cell.

***NICKEL METAL HYDRIDE BATTERIES*****5744259****NICKEL POSITIVE ELECTRODE FOR  
ALKALINE STORAGE BATTERY AND  
SEALED NICKEL-METAL HYDRIDE  
STORAGE BATTERY**

Ohta Kazuhiro; Okada Yukihiro; Hayashi Kiyoshi; Matsuda Hiromu; Toyoguchi Yoshinori Neyagawa, JAPAN assigned to Matsushita Electric Industrial Co Ltd

A nickel positive electrode for an alkaline storage battery having an improved utilization is disclosed. It comprises a nickel hydroxide powder and a cobalt hydroxide powder, wherein the cobalt hydroxide powder has a specific surface area of 10 m<sup>2</sup>/g or larger and a particle diameter of one-half or less of that of the nickel hydroxide powder. A nickel-metal hydroxide storage battery having this nickel positive electrode is also disclosed.

**5744263****ALKALINE STORAGE BATTERIES AND  
NICKEL ELECTRODES HAVING  
PLURALITY OF SUBSTRATES**

Inagaki Toru; Okamoto Katsuhir; Takeshima Hiroki; Hattori Yohei Kamakura, JAPAN assigned to Matsushita Electric Industrial Co Ltd

As a nickel electrode for alkaline storage batteries, an electrode plate comprising a plurality of electroconductive substrates and a plurality of active material layers which are alternately laminated and integrated is used, whereby mutual electric conductivity of the active material and the electroconductive substrate in the direction of thickness is increased, and active material utilization, discharge voltage characteristics as batteries and charge-discharge repetition life are improved. The nickel electrode comprises a plurality of electrode leaves each of which comprises an electroconductive substrate coated with an active material and which are laminated and integrated so that the electroconductive substrate and the active material layer are alternated with each other, a plurality of said electroconductive substrates being electrically and mechanically connected through a part of the respective electroconductive substrates, said electroconductive substrate having a thickness of 5-60 μm, said active material layer coated on the electroconductive substrate having a thickness of 20-250 μm.

**5744935****PROCESS AND APPARATUS FOR  
NICKEL-CADMIUM BATTERY REVIVAL**

Khoury Omar Fuad Amman, JORDAN

The invention resides in a process and an apparatus for the revival of nickel-cadmium batteries and cells suffering from low, zero, or negative terminal voltage and unrechargeability. The process revives the cells or batteries by the injection of a short-duration high-magnitude current pulse through them. The apparatus to carry out the process is built around a current source that is operated either manually or by a timer for the required duration.



**5747186****CELL AND MODULE BATTERY OF SEALED NICKEL-METAL HYDRIDE STORAGE**

Morishita Nobuyasu; Hamada Shinji; Matsuda Hiromu; Ikoma Munehisa Fujiidera, JAPAN assigned to Matsushita Electric Industrial Co Ltd

A cell for sealed nickel-metal hydride storage battery having a high energy density and a long cycle life is disclosed. It comprises a battery casing made of a synthetic resin which accommodates a power-generating unit including a hydrogen storage alloy negative electrode whose hydrogen equilibrium pressure is 0.01-0.1 MPa at 45°C, when H/M=0.5, and a lid for sealing an open end of the casing provided with a safety vent whose operation pressure is 0.2-0.8 MPa. A pressure-resistant strength of the battery casing is in a range of 0.7-2.0 MPa and set higher than the operation pressure of the safety vent by 0.5 MPa or more.

**COMPONENTS AND/OR CHARGERS****5741606****OVERCHARGE PROTECTION BATTERY VENT**

Mayer Steven; Whitehead John C San Leandro, CA, UNITED STATES assigned to Polystor Corporation

A cell pressure control system is disclosed which has a two stage control mechanism. In the first stage, increased cell pressure causes a conductive deflection member to bend to a position where it opens an electrical contact and places the cell in open circuit. This prevents current from flowing through the cell and thereby possibly slowing or preventing further increases in cell pressure. The electrical contact relies only upon the pressure of two members (one of which is the deflection member) pushing against one another. If the cell's internal pressure continues to increase even after the pressure contact is broken, the second stage of the pressure control mechanism is activated. Specifically, a pressure rupturable region in the above-mentioned

deflection member ruptures to relieve the cell's internal pressure. The pressure rupturable region is a circularity scored region on the conductive deflection member.

**5744931****BATTERY REMAINING CAPACITY MEASURING APPARATUS**

Arai Youichi; Ichikawa Hiroshi Susono, JAPAN assigned to Yazaki Corporation

A remaining capacity operation portion 19 provides an approximate linear function ( $I=aV+b$ ) having a voltage-current characteristic by a method of least squares according to an open circuit voltage when a load 1 is disconnected to a battery 3, a closed circuit voltage when a battery 3 is connected to a load 1 which is detected for every predetermined time and a current passing through a load, where a reference value ( $I<0$ ) is substituted in this approximate linear function, which a display portion 27 displays as an remaining capacity voltage.

**5744937****DUAL BATTERY CHARGING DEVICE FOR CHARGING NICKEL METAL-HYDRIDE AND LITHIUM-ION BATTERIES**

Cheon Kyung-Yong Suwon si, KOREA assigned to SamSung Electronics Co Ltd

A dual battery charging device for charging two different types of rechargeable batteries including a battery connector which connects with the battery; a charge circuit which supplies a charge current and a charge voltage to the battery connector to charge a battery; and a sensing controller which senses a temperature and a type of the battery and controls the charge current and the charge voltage output from the charge circuit according to the temperature and the type of the battery. Consequently, the present invention contemplates that either a NiMH battery or a lithium-ion battery can be charged by using a single dual battery charging device.

**5744963**

**BATTERY RESIDUAL CAPACITY  
MEASURING APPARATUS AND METHOD  
FOR MEASURING OPEN-CIRCUIT  
VOLTAGES AS THE BATTERY STARTS  
AND STOPS SUPPLYING POWER**

Arai Youich; Shimoyama Kenichi; Saigo Tsutomu; Takada Yoshihide Shizuoka ken, JAPAN assigned to Yazaki Corporation

While a power source is being supplied from a sub-battery by a voltage-current change trend calculating section, the voltage-current change trend calculating section collects currents from a battery and terminal voltages. A voltage-current approximate straight line calculating section obtains an approximately linear function, and a battery residual capacity calculating section obtains a residual capacity voltage based upon the approximately linear function and open-circuit voltages. A current storage stop discriminating section integrates the currents while the residual capacity voltage is lower than a previous residual capacity voltage, and when supplying from the sub-battery is stopped, obtains total capacity according to the open-circuit voltages at the stop and supplying and according to the integrated currents.

**5747189**

**SMART BATTERY**

Perkins Bradley Alan Mountain View, CA, UNITED STATES assigned to Valence Technology Inc

A battery and circuitry for monitoring state of charge of the battery are housed in a single housing. A display may be provided for displaying an indication of the state of charge, and a communication circuit may be provided for communicating electrical signals representing the state of charge to the exterior of the housing. Preferably, the battery module additionally includes a switch device for connecting the battery to terminals external to the housing and control circuitry responsive to the monitoring circuitry for causing the battery to be connected to and disconnected from the terminals. The control circuitry operates in accordance with thresholds to prevent deep discharge and overcharge.

**5747969**

**METHOD OF CHARGING A  
RECHARGEABLE BATTERY WITH  
PULSES OF A PREDETERMINED  
AMOUNT OF CHARGE**

Tamai Mikitak Sumoto, JAPAN assigned to Sanyo Electric Co Ltd

The charging method repeatedly charges and suspends charging to pulse charge a rechargeable battery. Charging is suspended only after a given amount of charge is transferred to the battery. Battery voltage is measured during the period of suspended charging, and charging is resumed only after the voltage of the battery drops below a first prescribed voltage. This situation is continuously repeated to pulse charge a rechargeable battery.

**OTHER BATTERIES**

**5743000**

**METHOD OF MAKING A REDUCED  
ENVIRONMENTAL HAZARD  
LECLANCHE CELL HAVING IMPROVED  
PERFORMANCE**

Ekern Ronald J; Armacanqui Miguel E; Rose Janna L Verona, WI, UNITED STATES assigned to Rayovac Corporation

An ionically permeable separator for a LeClanche cell, and methods of making and using same, are provided for in the invention. The separator comprises a Kraft paper separator and a corrosion-inhibiting coating thereupon selected to prevent corrosion of a zinc anode of the LeClanche cell. The separator may be configured for use in round or flat LeClanche cells. The separators of the invention may be used in heavy duty batteries containing an electrolyte comprising zinc chloride as a primary component. Cells made in accordance with the invention exhibit comparable or improved capacity and other performance characteristics in respect of conventional cells.

**5744258**

**HIGH POWER, HIGH ENERGY, HYBRID  
ELECTRODE AND ELECTRICAL  
ENERGY STORAGE DEVICE MADE  
THEREFROM**

Bai Lijun; Li Changming; Anani Anaba; Thomas Georg; Wu Han; Lian Ke Kery; Denton Frank R; Howard Jason Vernon Hills, IL, UNITED STATES assigned to Motorola Inc

A hybrid electrode for a high power, high energy, electrical storage device contains both a high-energy electrode material and a high-rate electrode material. The two materials are deposited on a current collector, and the electrode is used to make an energy storage device that exhibits both the high-rate capability of a capacitor and the high energy capability of a battery. The two materials can be co-deposited on the current collector in a variety of ways, either in superimposed layers, adjacent layers, intermixed with each other or one material coating the other to form a mixture that is then deposited on the current collector.

**5744266**

**BATTERIES AND A METHOD OF  
MANUFACTURING POSITIVE ACTIVE  
MATERIAL FOR THE BATTERIES**

Nunome Jun; Nakashima Takuya; Yoshizawa Hirosh; Tao Seiji Moriguchi, JAPAN assigned to Matsushita Electric Industrial Co Ltd

Heavy-load discharge characteristics of a primary battery are improved. Alternatively, the high-rate discharge characteristics of a secondary battery are improved. This is accomplished by employing manganese oxides as the positive active material on which a surface modified layer is formed. The surface modified layer consists of an oxide of at least one element selected from the group consisting of titanium, cobalt, nickel, strontium, lanthanum and its compound added mainly with a compound made of manganese oxide on the surface of manganese oxide powder consisting of manganese dioxide or a complex oxide of manganese and lithium.

This is accomplished by using a solution of salt of at least one element selected from the group consisting of titanium, cobalt, nickel, strontium, and lanthanum to which a manganese salt and a solution, to which a solution of manganese salt are added.

**5746780**

**METHOD OF MANUFACTURING A  
BATTERY CONTAINING A  
NON-CIRCULAR SPIRAL ELECTRODE  
UNIT**

Narukawa Satoshi; Amazutsumi Toru; Fukuda Hideki; Tamaki Hiyoshi Sumoto, JAPAN assigned to Sanyo Electric Co Ltd

A method of manufacturing a battery containing a non-circular spiral electrode unit forms a true circular or elliptical cylindrical electrode unit by winding positive and negative electrode plates with a micro-porous polymer film separator disposed between the two electrode plates. The cylindrical electrode unit is pressed from both sides into a non-circular spiral electrode unit and inserted into an external case to form a battery. When the cylindrical electrode unit is pressed into a non-circular spiral electrode unit, the separator gurley value of the pressed non-circular spiral electrode unit is arranged to be in the range from 110% to 150%, where the separator gurley value of the cylindrical electrode unit is 100%.

**5747191**

**MULTILAYERED BATTERY HAVING A  
CURED CONDUCTIVE INK LAYER**

Lake Rickie Eagle, ID, UNITED STATES assigned to Micron Communications Inc

The invention is directed to batteries having a nonconductive layer next to a conductive layer wherein the conductive layer comprises a cured conductive ink. The cathode is against the conductive ink layer.



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