A solid oxide fuel cell which has a fuel electrode and an air electrode respectively on a first surface and on a second surface of a solid electrolyte. The interface between the solid electrolyte and the fuel electrode, and the interface between the solid electrolyte and the air electrode are roughened. An exemplary way of roughening the interfaces is as follows: a green sheet of solid electrolyte, a green sheet of fuel electrode and a green sheet of air electrode are laminated with the green sheet of electrolyte in the middle; sandpaper is put on each of the green sheet of fuel electrode and the green sheet of air electrode with a plastic film in-between in such a manner that the rough surfaces of the sandpaper face the green sheets of electrode; the laminate of green sheets is press-fixed, whereby the rough surfaces of the sandpaper roughen the interfaces; and the sandpaper and the plastic films are removed.

## 5531956

## RIBBED ELECTRODES FOR MOLTEN CARBONATE FUEL CELLS

Ong Estela T; Burton-Gorman Nelli Chicago, IL, UNITED STATES assigned to Institute of Gas Technology

A method for producing a ribbed electrode for a fuel cell including the steps of depositing a suspension of a powdered electrode metal onto the face of a substantially flat porous electrode metal substrate, forming a plurality of raised structures on the face of the electrode, and sintering the electrode.

## 5532071

## PROCESS FOR SEALING HIGH-TEMPERATURE FUEL CELLS

Pal Uday; Landes Harald; Greiner Horst Needham, MA, UNITED STATES assigned to Siemens Aktiengesellschaft

A process for sealing leaks gas spaces and/or gas channels between individual components of high-temperature fuel cells, includes introducing at least first and second and optionally further different gases at high temperature from the outside into the gas spaces and/or gas channels to be sealed off from one another, for flushing every leak with the first gas on one side and with the second or further gas on the other side. The first gas contains at least one gaseous compound that can be oxidized to form a metal ion-conducting and/or an oxygen ion-conducting oxide, and the second and optionally further gas contains oxygen and/or is able to give off oxygen. The first gas contains at least one oxidizable compound of at least one of the metals of an electrolyte material, a bipolar plate and electrodes of the fuel cells, and/or one element of the group including zirconium, nickel, calcium, magnesium, cerium and rare earth metal. A high-temperature fuel cell produced by the process includes individual components having previously leaking points therebetween. Inlays of metal ion-conducting and/or oxygen ion-conducting oxides are disposed in the vicinity of the previously leaking points. The inlays are formed of oxides of at least one of the metals of electrolyte material, a bipolar plate, electrodes, zirconium, nickel, calcium, magnesium, cerium, hafnium and rare earth metal.

## 5532072

## SERIALLY ARRANGED FUEL CELLS FOR LARGE SCALE POWER GENERATION

Spaeh Richard; Westphal Manfred; Erdle Erich; Zurell Klaus-Peter Ueberlingen, GERMANY assigned to Dornier GmbH

A serially arranged construction of individual fuel cells implements large-scale systems for generating power. The fuel cells are packed with high density but in an exchangeable manner. Only the fuel gas is fed to the block of fuel cells by special conduits and connecting elements whereas the oxidation gas (e.g. air) is fed by an outside pressure difference between the front and rear sides of the fuel cell blocks. A large number of blocks can be mounted on a carrier plate in which fuel gas ducts are integrated to form a reinforcement and to directly feed the fuel gas into the blocks via pipe pieces mounted from the outside.

## 5532073

## FUEL CELL

Hirata Haruhiko; Hori Michio; Umiji Toru Kanagawa ken, JAPAN assigned to Kabushiki Kaisha Toshiba

A fuel cell having a plurality of unit cells stacked in layers, each of the unit cells including an electrolyte and a pair of electrodes, each of the unit cells having a first primary surface and a second primary surface; a plurality of separator elements interposed between the adjacent unit cells, a fuel gas channel being formed on a side of the first primary surface of each of the unit cells and an oxidant gas channel being formed on a side of the second primary surface of each of the unit cells; and manifold portions each of which penetrates the separator elements in a thickness direction and gas-tightly communicates with each of the fuel gas channel and the oxidant gas channel through holes formed in the separator elements. Each of the manifold portions including a plurality of dielectric manifold ring, a plurality of spacer members arranged with the separator elements in a stacking direction and in contact with each other, and a manifold portion fastening mechanism for generating a fastening pressure for pressing the surfaces of the spacer members against surfaces of the associated separator elements. As a result, the surfaces of the spacer members and surfaces of the separator elements are held in mechanical contact with each other by the manifold portion fastening mechanism.

**5534362**

## FUEL CELL STACK AND METHOD OF PRESSING TOGETHER THE SAME

Okamoto Takafumi; Tanaka Manabu; Baba Ichiro; Kato Hideo; Kawagoe Norimasa Wako, JAPAN assigned to Honda Giken Kogyo Kabushiki Kaisha

A fuel cell stack having unit cells and separators, in which each unit cell comprises a solid polymer electrolyte membrane having a pair of electrode catalysts attached on both surfaces, and a pair of collectors, each made of a rigid body, being in contact with respective electrode catalysts, and each of the separators comprises a pair of pressure generating plates defining therebetween a pressure chamber to which a pressurized fluid is introduced, the pressure generating plates being deformed by the pressurized fluid and pressed against the adjacent respective collectors.

# *BATTERY MATERIALS*

**5518836**

## FLEXIBLE CARBON FIBER, CARBON FIBER ELECTRODE AND SECONDARY ENERGY STORAGE DEVICES

McCullough Francis P Lake Jackson, TX, UNITED STATES

A novel flexible carbon fiber is disclosed which has a generally non-circular or tubular cross-sectional shape, a Young's modulus of from greater than 1 MM psi (6.9 GPa) to 55 MM psi (380 GPa), and a bending strain value of from greater than 0.01 to less than 50%. The invention also resides in an electrode for a secondary energy storage device utilizing the carbon fibers of the invention and containing a non-aqueous electrolyte. The invention further resides in a secondary energy storage device comprising a water impermeable housing having at least two cells containing at least one shared bipolar electrode made of the flexible carbon fibers of the invention. Also disclosed is a pseudo bipolar electrode and terminal electrode for use in a lithium ion battery in which the fibers or a portion of the carbon fibers are coated with an ion active lithium salt of a metal oxide. Also disclosed is a novel battery stack and a method of manufacture of the secondary energy storage device.

**5518975**

## SOLID ELECTROLYTE CERAMIC

Van Zyl Arnold; Ray Sikha Ulm, GERMANY assigned to Programme 3 Patent Holdings

A method of making a beta-alumina compound which is a polyaluminate of the general formula MyO*xAl2O3 in which M is a metal selected from monovalent metals and divalent metals, y=2 when M is a monovalent metal, y=1 when M is a divalent metal and x=4-12 comprises forming a green precursor of the 62 -alumina compound by mixing together particulate aluminium metal and a reagent compound comprising an oxide of the metal M or a precursor thereof. The mixture is heated to 800°-1150°C in an oxidizing environment to cause oxidation of at least part of the aluminium. Further heating then takes place to 1150°-1350°C in said