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(54) **METHOD FOR STORING ELECTRICITY IN QUANTUM BATTERIES**

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(57) **ABSTRACT**

A method with which Quantum Batteries (super capacitors) can be produced from materials which consists of chemically highly dipolar crystals in the form of nanometer-sized grains or layers that are embedded in electrically insulating matrix material or intermediate layers, and are applied to compound foil or fixed flat bases. Said materials are assembled so as to form wound capacitors or flat capacitors which are able to store electrical energy in a range of up to 15 MJ/kg or more without any loss due to the effect of virtual photon resonance.

METHOD FOR STORING ELECTRICITY IN QUANTUM BATTERIES

1.2. TECHNICAL FIELD

[0001] The storage device is independent from a stationary supply source and is therefore utilized to power electrical drives for the mobile traffic (road, train, ship as well as aviation) mainly aimed as energy substitute of fossil fuels. The high density resistance-loss-free storage technology allows also the application in energy supply for household and the transport of energy gained through solar technology. The special materials also allow the manufacture of new types of electronic components. The extreme fast and loss-free discharge of the electrically stored energy make it even possible to use the device also as explosive.

1.3. STATE OF THE TECHNOLOGY

[0002] The high specific weight when storing electrical energy in conventional batteries and also in capacitors is one of the major shortcoming for the application in mobile traffic. On the other hand the much more advantageous direct storage of chemical energy in fossil fuels and its ease of utilization led to an unacceptable waste of irrecoverable natural reserves. Furthermore the technical storage and discharge of electrical energy in e.g. lead batteries is bound to a high resistance, what results in high heat losses which does strongly limit loading and discharge speeds. The so far available "super capacitors" are functioning on a different physical principle. They operate only on low voltages, are sensible to mechanical shocks; show some elevated resistances and have several orders of magnitude lower energy and power densities.

1.4. DETAILED DESCRIPTION

1.4.1. Advantages

[0003] The new device allows to directly store electrical energy with a density in the same order of magnitude as energy can be stored as chemical energy in fossil fuels. Densities in the range of 1 until over 15 MJ/kg can be reached. The special materials of the new storage device allow nearly unlimited loading and discharging cycles, the material does not wear. During operation the storage device does not show losses due to resistance. The device is proof against any mechanical shock or excessive accelerations as well as extreme temperatures. Also any positioning in space is irrelevant.

1.4.2. Basis of the Invention

[0004] The invention is based on the physical effect that very small particles of a strong dipolar crystal material such as TiO_2 (strong electro negativity) embedded in an insulating matrix e.g. SiO2 or polymer resin and under the stress of a strong electrical field and at a critical voltage (loading condition) are becoming conductive (semiconductor) by means of virtual photon resonance (a new quantum physical effect) and are thus taking up energy which is then stored in a similar way as for a normal plate capacitor. The storage device can be built for voltages from a few volts to thousands of volts. The storage capacity is only limited by the maximum possible physical mechanical dimensions.

1.4.3. Technical Design

[0005] The storage crystals such as TiO2, SrTiO3 or similar, either ground to grains of some nm size or as nm-thick layers are applied together with an insulating medium on a carrier surface. There exists particular prerequisite for the type of the crystal, mainly the type "Rutile" is essential.

[0006] Two different processes are possible:

[0007] a) A mixture of ground crystals grains and polymer resin are first dispersed and then electrostatically sprayed on a compound film composed of a metal and a polymer foil, which is either continuously put on a flat table or wrapped around a tube-type mandril. The isolated metal foil of the compounded film is the counter electrode. Due to the insulating resin and the compound film the electrical charges when arriving with the wet resin on the surface cannot flow to ground. These charges are building together with the metal foil a very strong electrical field, which exerts by means of the capacitive effect very strong surface forces. These surface forces are causing geometrically exact forms, and in the case of the mandril exact round layers of extreme accurate thickness. Same, due to the strong surface forces also a high hydraulic pressure in the wet resin is applied so that the layers become air pore-free. Additionally the strong electrostatic field causes a proper alignment of the dipoles. The resin is then cured by heat or radiation. Thereafter the layered film is cut and formed into a multi layer capacitor. The cut films can either be arranged flat or wound up. Finally the metallic parts of the device are alternatively electrically connected forming the positive and negative poles of the storage device.

[0008] b) By means of Chemical Vapor Deposition (CVD) or Physical Vapor Deposition (PVD) several thin layers of the storage crystals e.g. TiO2 are deposited alternatively together with insulation layers e.g. SiO2 on a planar carrier surface which itself is covered by a conductive material such as e.g. platinum forming the bottom electrode. Through proper annealing at temperature at some 700° C. polycrystalline layers are achieved. After deposition of each resonance layer it becomes fully sandwich-type covered by an overlapping insulator layer providing also fixation. Thus after the subsequent annealing process above 800° C. for achieving the Rutile phase, when cooling down, the resonance layers do not delaminate even having strongly different thermal expansion coefficients. Finally a metallic cover layer is placed forming the top electrode of the device. It is also possible to deposit several combinations of layers.

[0009] Eventually the storage device will be coated by an isolating material and the electrodes connected to external clamps or through strip lines to the control logic.

1. A process for manufacturing of so called super capacitors respectively Quantum Batteries based on the 1.) physical effect through which electrical energy can be stored in resonance excited very small crystalline chemically dipolar particles or layers becoming thereby conductive and which are separated by an electrically insulating media, whereas these storage materials as a mixture of fluid resin e.g. a polymer and of pre-ground nanometer crystals are applied by means of electrostatic spraying on a 2.) preformed compound film which enclosed isolated metallic foil acts as 3.) counter electrode thereby creating a strong electrical field and together with capacitive effects causing strong surface forces which enable the forming of geometrically exact and compact layers and the field-aligning of the dipole crystals, where after the coated films being cut and eventually fabricated to 4.) flat-capacitor or 5.) wound-capacitor, such that these geometrically very precise, homogenous and compact layers fulfill the charging conditions of a Quantum Battery and that with such Quantum Batteries 6.) electrical energy can be stored in the order of magnitude of more than 15 MJ/kg. In accordance with claim **1**.) these materials with special electrical properties can also be applied on flat surfaces by means of chemical or physical 7.) vapor deposition whereby the electrical storage layers are alternatively deposited with the insulation layers such that these are sandwich-like overlapping for fixation in order that after annealing at above 800° C. for achieving Rutile phase and that after cooling, the storage layers do not delaminate because of different thermal expansion coefficients and eventually are forming a 8.) layer capacitor having extreme thin and accurate layers which proves to fulfill the loading conditions for a Quantum Battery and that with this Quantum Battery 9.) electrical energy at voltages in the range of few volts to thousands of volts and with densities of over 15 MJ/kg can be stored extremely fast.

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