

ELECTRODE ADHESIVE CELL

FIELD OF THE INVENTION

The present invention relates to cell, and particularly to a method for manufacturing an electrode adhesive cell, wherein the cell has no defect of the prior art cell and has preferred adhesive and plasticity. The properties of the cell are improved, and no plasticizer (such as DBP) is used. Advantages of the cell are that the manufacturing time is short. The cell is safe, high energy density, long lifetime, low internal impedance, matched to the requirement of environmental protection, and can provides larger power.

BACKGROUND OF THE INVENTION

A large amount of higher performance and lower cost secondary cells are required because various portable electronic products such as cellular phones, notebook computers, personal digital assistances (PDAs), etc., are developed. Lithium polymer most conforms to the above-mentioned requirements since it has the advantage of high energy density, long circulation times, high operation voltage, long storage life, as well as it is very safe upon using said cells.

In some prior art, such as U.S. patent No: 5,540,741 that utilizes poly vinylidene fluoride and hexa fluoropropylene as the binding agent. Further, they add di-butyl phthalate (DBP) as plasticizers for film-formation of the slurry of positive and negative electrode and the film-formation of films such that the polar plate of positive and negative charge and the films could be separated from a substrate after coating which also let the rear end electrode material is processed through heat-pressing with the electrode separator membrane & the electronic-collecting net. After they were unified into

bicell, it extracts DBP out by utilizing the solvents such as methanol so that there has a purity of pore structure for electrode plate and separator membrane.

The advantage of the above-mentioned fabricating method is mainly on the introduction of plasticizer, which let the electrode material having fine degree of plasticity after coating and thus it could combines the electronic collector, the plate material and the separator membrane, after the plasticizers being taken out, it has the effect of pore-forming, which forms the electrolyte conductor. Besides, since the positive and negative electrode are combined tightly through the separator membrane, the joint is difficult to form voids which interferes with the ion transport, and thus it is unnecessary to get rid of the requirement of tightly pressing the electrode of the outer package such that the cells are lighter and thinner. However, since it took too long to take out DBP, which consumes large amounts of extract solvent, it is easily to be left, which influences the performance of cells. That's its drawback.

SUMMARY OF THE INVENTION

Accordingly, the primary object of the present invention is to provide a method for manufacturing an electrode adhesive cell, wherein the cell has no defect of the prior art cell and has preferred adhesive and plasticity. The properties of the cell are improved, and no plasticizer (such as DBP) is used. Advantages of the cell are that the manufacturing time is short. The cell is safe, high energy density, long lifetime, low internal impedance, matched to the requirement of environmental protection, and can provides larger power.

The various objects and advantages of the present invention will be more readily understood from the following detailed description when read in conjunction with the appended drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a structural view of the cell of the present invention.

Fig. 2 is a perspective view of the cell of the present invention.

Fig. 3 is a structural view about the positive electrode of the cell of the present invention.

Figs. 4 and 5 are another structural views of the positive electrode of the present invention.

Fig. 6 is a structural view of the negative electrode of the present invention.

Figs. 7 and 8 are another structural views of the negative electrode of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

In order that those skilled in the art can further understand the present invention, a description will be provided in the following in details. However, these descriptions and the appended drawings are only used to cause those skilled in the art to understand the objects, features, and characteristics of the present invention, but not to be used to confine the scope and spirit of the present invention defined in the appended claims.

The process for manufacturing an electrode adhesive cell according to the present invention comprising the step of:

- (1) forming a solid state positive electrode film;
- (2) forming a solid state negative electrode film;
- (3) mixing polymer adhesive, a filler and two solvents of different boiling points as a mixing material; the mixing material being coated upon two opposite surfaces of a sheet of porous membrane (such as polyethylene

membrane or polypropylene membrane) as a coated object; the coated object being then dried as a separator membrane; the two solvents of different boiling points serving to solving the polymer adhesive; after the solvent of lower boiling point is evaporated, then the other solvent of high boiling point is retained as a gel with good adhesive and plasticity for the combination of the solid state positive electrode film and the solid state negative electrode film.

(4) Referring to Fig. 1, cutting the solid state positive electrode film 1, the solid state negative electrode film 2 and the separator membrane 3 to have predetermined sizes according to a desired capacity. The separator membrane 3 is clamped between the solid state positive electrode film 1 and the solid state negative electrode film 2. Then, compressing, heat-blowing and drying the combination structure as a cell 4.

(5) Referring to Fig. 2, welding a positive electrode conductive stem 40 and a negative electrode conductive stem 41 to the cell 4 and then welded cell 4 being placed into an aluminum film bag for vacuuming and then drying for dewater. Then electrolyte is filled into the bag for activating the cell 4.

Referring to Fig. 3, in the present invention, the method for forming the solid state positive electrode film 1 includes the step of mixing a polymer adhesive, two solvents (such as acetone and N-Methyl-2-pyrrolidone, NMP) of different boiling points, a conductive carbon, an active material into a slurry material 10; and then coating the slurry material 10 at two opposite surfaces of a current collector 11; and then the coated collector 11 being dried so as to form the solid state positive electrode film, wherein the current collector 11 may be an aluminum film. The two solvents of different boiling points serves to solve the polymer adhesive; after the solvent (such as acetone) of lower boiling point is evaporated, then the other solvent (such as

N-Methyl-2-pyrrolidone, NMP) of high boiling point is retained as a gel with good adhesion and plasticity for the combination of current collector 11.

Referring to Fig. 4, another method for forming the solid state positive electrode film includes the step of mixing a polymer adhesive, two solvents (such as acetone and N-Methyl-2-pyrrolidone, NMP) of different boiling points, a conductive carbon, an active material into a slurry material 10; and previously coating the slurry material 10 at one side surface of a PET (polyethylene terephthalate) substrate 12. Wherein the two solvents of different boiling points serves to solve the polymer adhesive; after the solvent (such as acetone) of lower boiling point is evaporated, then the other solvent (such as N-Methyl-2-pyrrolidone, NMP) of high boiling point is retained as a gel. After drying, the PET substrate 12 is taken down then the slurry material 10 as a positive electrode membrane. As shown in Fig. 5, the positive electrode membrane 13 is placed at two opposite sides of a netlike current collector 14 as a combining structure. Then the combining structure is heat-compressed as a solid state positive electrode film 1. In this process, the netlike current collector 14 is an aluminum net.

Referring to Fig. 6, in the present invention, the method for forming the solid state negative electrode film 2 includes the step of mixing a polymer adhesive, two solvents (such as acetone and N-Methyl-2-pyrrolidone, NMP) of different boiling points, a conductive carbon, an active material into a slurry material 20; and then coating the slurry material 20 at two opposite surfaces of a current collector 21; and then the coated current collector 21 being dried so as to form the solid state negative electrode film 2, wherein the current collector 21 may be a copper film. The two solvents of different boiling points serves to solve the polymer adhesive; after the solvent (such as acetone) of lower boiling point is evaporated, then the other solvent (such as

N-Methyl-2-pyrrolidone, NMP) of high boiling point is retained as a gel with good adhesion and plasticity for the combination of current collector.

Referring to Fig. 7, another method for forming the solid state negative electrode film includes the step of mixing a polymer adhesive, two solvents (such as acetone and N-Methyl-2-pyrrolidone, NMP) of different boiling points, a conductive carbon, an active material into a slurry material 20; and previously coating the slurry material 20 at one side surface of a PET (polyethylene terephthalate) substrate 22. Wherein the two solvents of different boiling points serves to solve the polymer adhesive; after the solvent (such as acetone) of lower boiling point is evaporated, then the other solvent (such as N-Methyl-2-pyrrolidone, NMP) of high boiling point is retained as a gel. After drying, the PET substrate 22 is taken down then the slurry material 20 as a negative electrode membrane. As shown in Fig. 8, the negative electrode membrane 23 is placed at two opposite sides of a netlike current collector 24 as a combining structure. Then the combining structure is heat-compressed as a solid state negative electrode film 2. In this process, the netlike current collector 24 is a copper net.

The present invention is thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the present invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

WHAT IS CLAIMED IS:

1. A method for manufacturing an electrode adhesive cell, comprising steps of:

(a) forming a solid state positive electrode film;

(b) forming a solid state negative electrode film;

(c) mixing polymer adhesive, a filler and two solvents of different boiling points including acetone and NMP(N-Methyl-2-pyrrolidone) as a mixing material; the mixing material being coated upon two opposite surfaces of a porous membrane as a coated object; the coated object being then dried as a separator membrane; the two solvents of different boiling points serving to solving the polymer adhesive; after the acetone solvent of lower boiling point is evaporated, the other NMP(N-Methyl-2-pyrrolidone) solvent of high boiling point is retained as a gel with good adhesive and plasticity for the combination of solid state positive electrode film and solid state negative electrode film; and

(d) cutting the solid state positive electrode film, the solid state negative electrode film and the separator membrane to have predetermined sizes according to a desired capacity; the separator membrane being clamped between the solid state positive electrode film and the solid state negative electrode film; then, compressing, heat-blowing and drying the combination structure as a bicell.

2. A method for manufacturing an electrode adhesive cell comprising the steps of:

(a) forming a solid state positive electrode including the step of mixing a polymer adhesive, two solvents of different boiling points including acetone and NMP(N-Methyl-2-pyrrolidone), and electrode material into electrode slurry; the electrode slurry material being coated upon two opposite sides of a

current collector as a combination structure; after drying, the combination structure is formed as a solid state positive electrode film; the two solvents of different boiling points serving to solve the polymer adhesive; wherein after the acetone solvent of lower boiling point is evaporated, then the other NMP(N-Methyl-2-pyrrolidone) solvent of high boiling point is retained as a gel with good adhesive and plasticity for the combination of solid state positive electrode film and the current collector;

(b) forming a solid state negative electrode film including the step of mixing and then grinding a polymer adhesive, two solvents of different boiling points including acetone and NMP(N-Methyl-2-pyrrolidone), and electrode material into a negative electrode slurry material; then the negative electrode film is placed upon two opposite sides of a current collector as a combining structure; then the combining structure is dried so as to form a solid state negative electrode film; the two solvents of different boiling points serving to solve the polymer adhesive; wherein after the acetone solvent of lower boiling point is evaporated, then the other NMP(N-Methyl-2-pyrrolidone) solvent of high boiling point is retained as a gel with good adhesion and plasticity for the combination of the solid state negative electrode film and the current collector;

(c) forming a separator membrane including the step of mixing a polymer adhesive, a filler and two solvents of different boiling points including acetone and NMP(N-Methyl-2-pyrrolidone) into slurry material; the slurry material being coated upon two opposite sides of a porous membrane as a combination structure; after drying, the combination structure is formed as a separator membrane; the two solvents of different boiling points serving to solve the polymer adhesive; wherein after the acetone solvent of lower boiling point is evaporated, then the other NMP(N-Methyl-2-pyrrolidone) solvent of

high boiling point is retained as a gel with good adhesive and plasticity for the combination of the solid state positive electrode film and the solid state negative electrode film;

(d) cutting the solid state positive electrode film, the solid state negative electrode film and the separator membrane into predetermined sizes; then they are compressed and hot dried so as to form as a bicell.

3. A method for manufacturing an electrode adhesive cell comprising the steps of:

(a) forming a solid state positive electrode film including the step of mixing a polymer adhesive, two solvents of different boiling points including acetone and NMP(N-Methyl-2-pyrrolidone), and electrode material into a positive electrode slurry material; the positive electrode slurry material being previously coated at one side surface of a substrate, wherein the two solvents of different boiling points serves to solve the polymer adhesive; after the acetone solvent of lower boiling point is evaporated, then the other NMP (N-Methyl-2-pyrrolidone) solvent of high boiling point is retained as a gel; after drying, the substrate is taken down then the slurry material as a positive electrode membrane which are placed at two sides of a netlike current collector; after hot compressing, it being formed as a solid state positive electrode film;

(b) forming a solid state negative electrode film including the step of mixing a polymer adhesive, two solvents of different boiling points including acetone and NMP(N-Methyl-2-pyrrolidone), and electrode material into a negative electrode slurry material; the negative electrode slurry material being previously coated at one side surface of a substrate, wherein the two solvents of different boiling points serves to solve the polymer adhesive; after the acetone solvent of lower boiling point is evaporated, then the other NMP

(N-Methyl-2-pyrrolidone) solvent of high boiling point is retained as a gel; after drying, the substrate is taken down then the slurry material as a negative electrode membrane which are placed at two sides of a netlike current collector, after hot compressing, it being formed as a solid state negative electrode film;

(c) forming a separator membrane including the step of mixing a polymer adhesive, a filler, two solvents of different boiling points including acetone and NMP(N-Methyl-2-pyrrolidone) into slurry material; the slurry material being coated upon two opposite sides of a porous membrane as a combination structure; after drying, the combination structure is formed as a separator membrane; the two solvents of different boiling points serving to solve the polymer adhesive; wherein after the acetone solvent of lower boiling point is evaporated, then the other NMP(N-Methyl-2-pyrrolidone) solvent of high boiling point is retained as a gel with good adhesion and plasticity for the combination of the solid state positive electrode film and the solid state negative electrode film;

(d) cutting the solid state positive electrode film, the solid state negative electrode film and the separator membrane into predetermined sizes; then they are compressed and hot dried into bicell.

4. The method for manufacturing an electrode adhesive cell as claimed in claims 1, wherein the porous membrane is one of a polyethylene membrane and a polypropylene membrane.

5. The method for manufacturing an electrode adhesive cell as claimed in claims 2, wherein the current collector of the solid state positive electrode film is aluminum film, and the current collector of the solid state negative electrode film is copper film.

6. The method for manufacturing an electrode adhesive cell as claimed in

claims 3, wherein the substrates in the solid state positive electrode film and solid state negative electrode film are PET (polyethylene terephthalate); and the netlike current collector of the solid state positive electrode film is aluminum net, and the netlike current collector of the solid state negative electrode film is copper net.