

The invention relates to a galvanic cell of flat construction, in particular a button cell, having a positive electrode and a negative electrode which, as pressed powder electrodes in the form of pellets, has a covering comprising a liquid-permeable metal mesh material as a reinforcement and as a current collector, and having an interposed electrolyte-impregnated separator in a tightly sealed housing.

Particularly typical cells which are described by the generic clause above are the known gas-tight Ni/Cd button battery cells. However, the field of application of the invention is not restricted to secondary cells but also extends to primary cells, for example the alkaline system AgO/Zn if they are of flat construction and preferably contain in button cells electrodes which are formed from metal mesh-reinforced pellet-type powder pressings of the respective active material.

The electrode pellets are produced from pulverized, partially granulated active raw-material masses on commercially available pelletizing presses. Conventionally, portions of metal powders or carbon as the conductor are mixed in with the active masses.

A binder which is furthermore added to the electrode mass, e.g. PTFE powder, on the one hand increases the dimensional stability of the pellet and improves its handlability, especially during assembly, but on the other hand, because of its water-repelling action, influences the electrical loading capacity of the electrode at high currents in an unfavourable way.

Consequently, binder-free electrodes are necessary for the transportation procedures in the electrolyte balance but tend to swell and become sludgy. As a result of a reinforcement covering the electrode and comprising a metal cloth mesh, as known primarily from electrode pellets in Ni/Cd button cells, these deficiencies are suppressed more effectively than by a binder. Coverings of this type additionally take on the function of electronic current collection to the cell housing.

DE-PS 30 36 295 discloses an electrode enclosure in a newer construction. In practice, in the case of the known cloth meshes comprising warp and weft wires, other disadvantages have furthermore emerged: as a result of the crossing of the warp and weft wires, the material thickness at the node points of the mesh grid is increased, which, especially in the case of thin electrodes, causes a perceptible loss of volume because it is not compensated by an active electrode mass with usable energy. The mesh size of the free spaces delimited by the wires is relatively small by comparison with the wire thicknesses, and the effective free electrode surface is also correspondingly small. A particular risk is formed by the wire ends which result from punching out the cloth blanks for electrode baskets and covers, because they can penetrate thin separator foils and cause short circuits with the counter-electrode. Finally, metal cloth meshes are expensive.

The object of the invention is therefore to replace the known metal cloth for protectively enclosing the electrode pressed body by a better metal mesh material. The object is achieved in accordance with the invention by a galvanic cell as defined in Claim 1.

It has been found that thin expanded metal foils are suitable for the purpose of "packaging" powder pressed electrodes in at least the same way as the metal wire cloth meshes which are otherwise conventional. Moreover, they are lower in cost.

As the starting material, smooth foils or endless strips of a metal which behaves chemically inertly with respect to the possible electrode reactions in the cell are possible. Preferably, the metal is a special steel, a nickel-plated steel, nickel or copper.

The thickness of this starting material is between 0.05 mm and 0.15 mm, preferably around 0.1 mm.

The expanded metal manufacturer offers expanded mesh foils of this material in a wide selection as regards mesh geometry and mesh size, so that it is possible to resort to a suitable covering material without problems in producing the electrode. The expanded mesh foils used according to the invention have a web width of 0.1 mm to 0.3 mm, preferably around 0.15 mm, and can have mesh sizes which are 10 to 15 times the web width without the thickness of the starting material having to be increased.

The degree of stretching or drawing can be set as desired using the machine-dependent manufacturing techniques. The shapes of the cutters and the placing of their incisions in the starting foil in this case also determine the geometry of the intermediate spaces or grid meshes.

Thus, in the case of a high degree of stretching, honeycomb-type grid meshes can be constructed with upright webs which stand almost perpendicular to the plane of the mesh. The degree of opening of an expanded mesh of this type is optimum, but on the other hand the volume it takes up is the maximum. A great many expanded metals have a lozenge pattern. Lozenge-shaped meshes are preferred in the case of the expanded mesh foils used according to the invention. As the degree of stretching increases, the lozenge shape continues to approach a square. In parallel therewith there is a larger degree of opening of the grid and a smaller material consumption. The high level of distortion of the webs produces a certain rigidity of the expanded mesh foil which has a favourable influence on the mechanical strength of the electrode surface. By subsequently rolling the expanded mesh foil, the webs can, however, also be pressed flat because of the thin material, so that the loss of volume of the electrode is minimal with this covering.

In accordance with this, it is possible to make available in the greatest variety of variants an expanded mesh foil, depending on the requirements made by the consistency of the active materials which is to be enclosed and which is pressed from powder. If,

for example, the desire for a high current-loading capacity is dominant, then because of the low degree of covering an expanded metal which is as large-mesh as possible will be chosen. If, on the other hand, a high degree of mechanical strength of the electrode is called for, a mesh having a pronounced profile will be preferred and a larger dead volume accepted in consequence. Thus, in the case of using expanded mesh foils in the manner according to the invention, there are sufficient compromises between these requirements and the general desire to keep the volume occupied by the electrochemically unusable covering material to a minimum.

Packaging of powder pressed electrodes for button cells by means of expanded mesh foils according to the invention takes place in a manner similar to the procedure with the known reinforcements of nickel cloth. Rounds are punched out of an expanded mesh foil and shaped into baskets and the electrode pellets are laid in these. Further rounds corresponding to the internal diameter of the baskets are used to cover the pellets and the upwardly projecting edges of the baskets are turned around over the covering rounds. A subsequent pressing of this arrangement between a top and a bottom die gives the electrode the final shape and size. Another closing technique, following the process disclosed in DE-PS 30 36 295, can consist in punching out of the expanded foil material a cup in such a way that the closing edge of the cup extends radially outwards from the side wall and forms a planar collar.

Once the pellet has been placed in the cup, a punched covering round of the same foil material but of a size such that it forms a common closing edge with the collar of the cup is placed on. By bending the edges around by 90° towards the cup outer casing they are folded together.

Two figures are intended to illustrate the subject of the invention.

Figure 1 shows a galvanic cell according to the invention, in cut-away illustration.

Figure 2 shows details of two expanded mesh foils with lozenge shapes which are preferred according to the invention.

In the Ni/Cd button cell 1 which has been chosen as the example in Figure 1, both the positive electrode 2 and the negative electrode 3 have a covering comprising a metal expanded mesh foil 4. The expanded metal has to be chemically inert in relation to the electrode processes; in this case it is preferably of nickel.

5 designates the separator, 6 a base insert, 7 a sealing ring and 8 a contact spring.

Figure 2 reproduces details of two expanded mesh foils a, b which are suitable for covering the electrode in accordance with the invention and which are enlarged by approximately 20 times. The expanded meshes which have been rolled flat here differ merely by the height clearance h of the lozenge-shaped mesh. Thus, for expanded mesh a, $h = 0.7$ mm; for expanded mesh b, $h = 1.0$ mm.

The other characteristic dimensions are the same: web width $s = 0.15$ mm; width of the crossing points of the mesh $c = 0.3$ mm; mesh length $l = 1.5$ mm.

The expanded mesh b having approximately square mesh is particularly preferred. Here, the mesh width (height clearance h) is 6 times the size of the web width's.

The advantages of an electrode reinforcement by means of expanded mesh foils over a conventional one of metal cloth mesh become clear simply from the fact that in the latter the mesh width of the cavities between the wires is only 2 to 5 times the wire thickness, which is 0.05 to 0.3 mm in the cloths in question. In this case, the cross-section of the cloth wires restricts the effective free electrode surface to a greater extent than is

generally the case with the oblique expanded metal webs having a material thickness of 0.05 mm to 0.15 mm.

Expanded metal foils are not encumbered by the disadvantage of unalterable double wire layers in the mesh delimitations in the case of wire cloths, make less intensive use of material and are cheaper to produce.



1. Galvanic cell of flat construction, in particular a button cell, having a positive and a negative electrode which, as pressed powder electrodes in the form of pellets, have a covering comprising a liquid-permeable metal mesh material as a reinforcement and as a current collector, and having an interposed electrolyte-impregnated separator in a tightly sealed housing, characterized in that the mesh material is an expanded mesh foil (4).
2. Galvanic cell according to Claim 1, characterized in that the metal on which the expanded mesh foil is based is a metal which does not take part in the electrochemical electrode processes, preferably a stainless steel, nickel or a nickel-plated steel.
3. Galvanic cell according to Claims 1 and 2, characterized in that the expanded mesh foil is produced from a foil material or endless strip which is 0.05 mm to 0.15 mm, preferably 0.1 mm, thick.
4. Galvanic cell according to Claim 3, characterized in that the pattern of the expanded mesh of the expanded mesh foil is in the shape of a lozenge.
5. Galvanic cell according to Claim 4, characterized in that the web width s of the mesh is 0.1 mm to 0.3 mm, preferably 0.15 mm, and the height clearance h of the lozenge-shaped mesh opening (shorter diagonal of the lozenge) is 1 to 6 times larger than the web width.
6. Galvanic cell according to Claim 5, characterized in that the shorter diagonal of the lozenge is approximately 1 mm, the shape of the lozenge being close to a square.