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NASA TECH BRIEF

Goddard Space Flight Center

Honeycomb Battery Plaque

The problem:

In conventional sintered nickel plaques used as supports in nickel cadmium and nickel zinc batteries, the pores are not uniform in size or in shape and are interconnected randomly. Because of this randomness, the active material used in battery electrodes made from such supports cannot be coated uniformly throughout. As a result, the electrodes are rather inefficient and can terminate the service life of batteries prematurely.

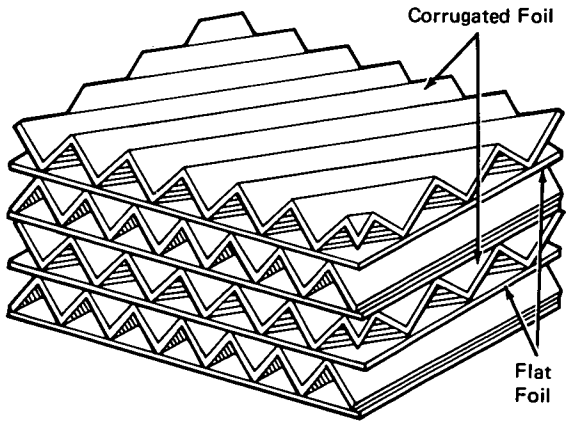
The solution:

The performance of porous electrodes in batteries and other electrochemical cells is greatly improved when the supports for the active material have pores of uniform size, extending completely through the electrodes, from side to side, with no interconnections between the pores.

How it's done:

Porous conductive supports for the electrodes are made with thin corrugated nickel foil. Pieces of this corrugated foil are stacked and bonded with the adjacent pieces oriented at different angles. The bonded stacks then are cut in planes perpendicular to the foils (see figure). Pieces of smooth thin metal foil can be placed between adjacent pieces of the corrugated foil.

The corrugated foil is about 0.3 to 1 mil (0.008 to 0.03 mm) thick, and the flat foil is about 0.2 to 1 mil (0.005 to 0.03 mm) thick. The corrugations are triangular, with each corrugation about 2 to 6 mils (0.05 to 0.2 mm) high and 2 to 10 mils (0.05 to 0.3 mm) wide; the height is at least about one-half the width. The density of the support is less than about 25 percent. Alternate pieces of the corrugated foil are oriented with corrugations in approximately the same direction, and the angle between the corrugations in successive pieces of the corrugated foil typically is about 5 to 40 degrees.



Porous Conductive Support Structure for Electrodes Used in Electrochemical Cells

The pieces of foil then are bonded by heating in a nonoxidizing atmosphere such as hydrogen, and the adjacent pieces are bonded at all contiguous points.

The planes in which the stack is cut are parallel, about 25 to 50 mils (0.6 to 1.3 mm) apart, and are perpendicular to the direction bisecting the angle between the corrugations in successive pieces of the corrugated foil. Before the cutting, the bonded structure is filled with an epoxy, which is removed after the cutting by dissolving it in a hot chromic acid solution [typically, about 250 to 600 grams/liter of chromic acid at about 140° to 200° F (59° to 92° C)].

The corrugated foil is electroformed on a conductive corrugated surface, the corrugations being polished to a highly-smooth surface finish from which the electroformed foil is readily removable. Normally, the foil is electroformed on a cylindrical mandrel comprising a continuous helical threaded portion. The forming surface then is subjected to a fine polishing, using a slurry of fine abrasive particles in water spread over the surface by a fine wire brush, and then is plated with bright chromium.

(continued overleaf)

Notes:

1. Additional information is contained in Tech Brief B73-10515.
2. Requests for further information may be directed to:
   Technology Utilization Officer
   Goddard Space Flight Center
   Code 207.1
   Greenbelt, Maryland 20771
   Reference: TPS73-10519

Patent status:

This invention has been patented by NASA (U.S. Patent No. 3,759,747). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

Patent Counsel
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Source: Glenn R. Schaer of
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