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MANUFACTURE OF NICKEL ELECTRODES
FOR ALKALINE CELLS

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4 Claims

ABSTRACT OF THE DISCLOSURE

The specification describes a technique for activating
nickel electrodes for nickel-cadmium cells. If a pre-
scribed amount of chloride ion is added to the standard
nickel nitrate electrolyte during cathodic precipitation an
improvement in the cycle life of the nickel electrode
results.

This invention relates to nickel-cadmium cells and
particularly to methods for preparing electrodes which
evidence improved electrode cycle life.

Foraminius electrodes for nickel-cadmium cells are
conventionally activated by the cathodic precipitation
technique. This method involves electrolyzing the foram-
inuous plaque as the cathode in a solution of a nickel salt
such as nickel nitrate. Nickel hydroxide precipitates in
the interstices of the plaque to form the active material
for the battery electrode.

It has now been found that if the nickel salt solution
contains a critical amount of a soluble chloride, elec-
trodes treated in this solution exhibit significantly longer
cycle life. Specifically, it has been found that electrodes
activated in this solution give twice the number of deep
charge-discharge cycles before their capacity drops sig-
nificantly as compared with electrodes prepared using a
similar solution without chloride.

The electrolyzing conditions and parameters are stand-
ard in the art. The concentration of nickel nitrate can
vary from 0.1 M to saturation. Concentrations in the
range of 2.0 M to 7 M are most desirable in terms of
efficiently producing uniformly impregnated electrodes
at a rapid rate. Current densities in the range of 0.1 to
7.0 amperes per square inch are useful and again the
higher current densities, 2.0 to 7.0 amperes per square
inch, are preferred. The temperature of the electrolyte
does not appear to be an important factor. Prior ex-
perience with cathodic precipitation indicated no ap-
preciable difference in experiments conducted at 25° C.,
50° C. and 70° C.

The following example illustrates the practice of the
invention.

Nickel foil electrodes were made cathodic in 0.5 M
Ni(NO₃)₂ containing varying amounts of NaCl. The
cathode current density was maintained at approximate-
ly 0.032 ampere per square inch of real surface area.
Platinum anodes were used but carbon, or other non-
contaminating electrode materials can be used as well.
Nickel anodes which have the virtue of replenishing nickel
ions in the solution may also be used. Total current
passed in each case was 31 coulombs per square inch.
In those examples in which the molarity of nickel nitrate
was 2, the current density was 0.16 ampere per square
inch and the total current passed was 58 coulombs per
square inch. The plates activated in this way were then

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electrically cycled to determine their cycle life. Cycling
consisted of discharging to approximately zero percent
of capacity and recharging to capacity both at a C/2
rate in 30 percent KOH. The results of these studies are
tabulated in the following table. The cycle life given is
the number of cycles for which the plate delivered at
least 50 percent of original capacity.

TABLE

Molarity of Nickel Nitrate	Molarity of Chloride	Number of cycles
0.5	No chloride	65
0.5	0.025	57
0.5	0.1	50
0.5	0.5	108
0.5	1.0	90
0.5	2.0	78
0.5	Saturated	75
2.0	No chloride	90
2.0	0.35	50
2.0	0.5	150
2.0	1.0	130
2.0	2.0	82

From the data of the table it is seen that the concen-
tration of chloride is fairly critical approaching 0.5 M
and the effectiveness of the chloride additive begins to
decline significantly at concentrations above 1.0 M. On
the basis of extrapolated data a range of chloride con-
centration of 0.4 M to 1.5 M can be prescribed as
critical to obtaining the useful benefits of this invention.

The chloride can be added in the form of any soluble
salt such as the alkali metal chlorides, alkaline earth
metal chlorides, ammonium chloride, hydrochloric acid
or any equivalent of these.

Various additional modifications and extensions of this
invention will become apparent to those skilled in the
art. All such variations and deviations which basically
rely on the teachings through which this invention has
advanced the art are properly considered within the spirit
and scope of this invention.

What is claimed is:

1. In the fabrication of nickel positive electrodes for
alkaline cells the step of activating the nickel electrode
by electrolyzing the nickel electrode as cathode at a cur-
rent density in the range of 0.1 to 7.0 amperes per
square inch in an aqueous electrolyte consisting essen-
tially of nickel nitrate and chloride ions having concen-
trations in the range of 0.5 M to saturation and 0.4 M
to 1.5 M respectively.

2. The method of claim 1 wherein the nickel nitrate
concentration is in the range of 2.0 M to 7.0 M.

3. The method of claim 2 wherein the current density
is in the range of 2.0 to 7.0 amperes per square inch.

4. The method of claim 1 wherein the chloride ion
concentration is approximately 0.5 M to 1.0 M.

References Cited

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