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Magnesium Mercurous chloride depolarised battery.

Council of Scientific and Industrial Research, Rafi
Marg, New Delhi-1, India, an Indian registered body
Incorporated under the Registration of Societies Act
(Act XXI of 1860).

The following specification describes the nature of
this invention.

This is an invention by Shri Kallunkal Visvanatha Prasad,
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India, all Indian citizens.

PRICE - Rs.2.00

This invention relates to the development of magnesium mercurous chloride battery system.

Hitherto it has been proposed to use silver chloride, cuprous chloride and lead chloride as cathode elements in conjunction with magnesium anode in magnesium family of batteries. Magnesium-silver chloride, magnesium-cuprous chloride batteries have already been commercialised and available in the market for special application. Magnesium-silver chloride battery is largely used for defence, naval purposes whereas magnesium cuprous chloride battery system has been adopted in meteorological application because of its low temperature, operational capability. Among the sparingly soluble halides, lead chloride, mercurous chloride and thallium chloride are the other materials which can constitute depolariser materials against magnesium in batteries. Magnesium lead chloride battery system has already been patented. Mercurous chloride electrode has so far been used extensively as the reference half cell in the measurement of potentials of any electrode. But it has not been used so far as a depolariser material in a power source. Since mercurous chloride is a stable compound in a-atmosphere and the system has got appreciably high reduction potential and high exchange current density, this material is highly suitable as cathodic depolariser for a halide cell system.

This is open to objection that magnesium silver chloride battery system is too expensive for wider applications; magnesium cuprous chloride is not much suitable for ordinary temperature requirements and also it cannot be discharged at high rates.

The object of this invention is to obviate these disadvantages by using mercurous chloride as cathode material in conjunction with magnesium electrode in developing a new battery system. This battery system has got an important characteristics of discharging at heavy drain, operating at ordinary temperature and is much less expensive than silver-chloride battery system.

To these ends, the invention broadly consists in fabrication of magnesium mercurous chloride battery system wherein mercurous chloride is used as cathodic depolariser and magnesium or its

alloys as anode element. The cell can be activated with magnesium perchlorate, magnesium bromide, sodium chloride or any other similar electrolytes.

The following typical examples are given to illustrate the invention:

Example 1:

A cell consisting of magnesium alloy AZ31 (containing aluminium and zinc in trace amounts) anode of 10 sq. cm is coupled with a 10 sq. cm. (5.4g) mercurous chloride electrode, prepared by pressing a paste consisting of 95% to 75% mercurous chloride, 5% to 25% of acetylene black and an organic binder like CMC, PVA. The pressure applied was between 5 and 35 tons. The two electrodes are separated by means of single or multiple separator consisting of filter paper, cellophane paper, nylon cloth and the like materials. The cell is activated with 3% sodium chloride solution. It operated between 1.5 and 1.3 volts and gave above 90% energy output within 0.2 volts' variation in the cell voltage at 5 hours' rate. The cathodic material efficiency is normally obtained between 95 and 90% at 6 hours discharge rate. The cell was capable of being discharged at 5 hours and lower rates of discharges.

Example 2:

A cell similar to the one described in Example 1 was assembled. The cell was activated with magnesium perchlorate as against sodium chloride solution used in experiment 1. The cell gave similar performance to the one described under Example 1 with the exception that the cell voltage was a little lower by an order 0.1V but the cathodic material efficiency was higher ranging between 97.5 and 95% at 6 hour discharge rate.

The following are the main advantages of the invention:

1. The cell is capable of high drain and therefore it can be used as heavy duty battery system for special applications.
2. It operates within a narrow voltage range, say, 0.2V to deliver 90% of its capacity.

3. The cell system is much cheaper than magnesium-silver chloride battery system which is presently used for naval applications because of its heavy drain characteristics.
4. The mercurous chloride is stabler chemically than cuprous chloride and so this cell system possesses longer shelf-life than magnesium-cuprous chloride.
5. The cell system constitutes a high energy density battery system.
6. The cell system is potentially useful for use as activated wet cell, dry cell, as well as single shot cell.
7. The cell system gets activated in less than a minute and so it is extremely good as an activated battery system.

Dated this 22nd day of June, 1971.

Sd/-

Asstt. Patents Officer,
Council of Scientific & Industrial Research

THE PATENTS ACT, 1970

COMPLETE SPECIFICATION

SECTION 10

MAGNESIUM MERCUROUS CHLORIDE DEPOLARISED BATTERY
SYSTEM.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH,
Rafi Marg, New Delhi-1, India, an Indian registered body
incorporated under the Registration of Societies Act (Act XXI
of 1860).

The following specification particularly describes and
ascertains the nature of this invention and the manner in which
it is to be performed :-

This invention relates to the development of a magnesium-mercurous chloride depolarised battery.

Hitherto it has been proposed to use silver chloride, cuprous chloride and lead chloride as cathode elements in conjunction with magnesium anode in magnesium family of batteries. Magnesium-silver chloride, magnesium-cuprous chloride batteries have already been commercialised and available in the market for special application. Magnesium-silver chloride battery is largely used for defence, naval purposes whereas magnesium cuprous chloride battery system has been adopted in meteorological application because of its low temperature, operational capability. Among the sparingly soluble halides, lead chloride, mercurous chloride and thallium chloride are the other materials which can constitute depolariser materials against magnesium in batteries. Magnesium lead chloride battery system has already been patented. Mercurous chloride electrode has so far been used extensively as the reference half cell in the measurement of potential of any electrode. But it has not been used so far as a depolariser material in a power source. Since mercurous chloride is a stable compound in atmosphere and the system has got appreciably high reduction potential and high exchange current density, this material is highly suitable as cathodic depolariser for a halide cell system.

This is open to objection that magnesium silver chloride battery system is too expensive for wider applications; magnesium cuprous chloride is not much suitable for ordinary temperature requirements and also it cannot be discharged at high rates. Whereas cuprous chloride system works well between 0°C to -80°C . Its performance is poor above 5°C owing to the generation of considerable amount of heat due to a chemical reaction in the cell system. On the other hand, mercurous chloride system does not generate heat and operates well upto 40°C .

The object of this invention is to obviate these disadvantages by using mercurous chloride as cathode material in conjunction with magnesium electrode in developing a new battery system. This battery system has got an important characteristic of discharging at heavy drain, operating at ordinary temperature and is much less expensive than silver chloride battery system.

According to the present invention, there is provided Magnesium-Mercurous Chloride depolarised battery consisting mercurous chloride cathode and magnesium anode and activated by inorganic electrolytes characterised in that the cathode is

fabricated from a mixture of mercurous chloride, acetylene black and an organic binder such as polyvinyl alcohol, carboxymethyl cellulose, starch and the other electrode is magnesium or an alloy of magnesium. Mercurous chloride is used as cathodic depolariser and magnesium or its alloys as anode element. The cell can be activated with magnesium perchlorate, magnesium bromide, sodium chloride or any other similar electrolyte.

Magnesium mercurous chloride system constitutes a new addition to the family of halide batteries. Although other metal chlorides like silver chloride, cuprous chloride and lead chloride have been used in conjunction with magnesium to develop as a power source. Mercurous chloride which is the well-known highly reversible material used in reference electrode was not tried earlier as cathode material in the development of a power sources.

The present invention consists of a cell device for generating electrical energy which comprises of magnesium or magnesium alloy anode, mercurous chloride cathode and inorganic electrolytes such as those of sodium chloride, magnesium perchlorate, magnesium bromide and the like, wherein the mercurous chloride cathode consists of a mix of mercurous chloride salt, acetylene black or a metal powder, a binder like carboxy methyl cellulose, polyvinyl alcohol, starch is pasted and pressed over a metallic wire mesh support. The electrode is wrapped in separators like tissue paper, cellophane paper, nylon cloth and likewise.

The following typical examples are given to illustrate the invention :

Example 1

A cell consisting of magnesium alloy AZ31 (containing aluminium and zinc in trace amounts) anode of 10 sq. cm. is coupled with a 10 sq. cm. (5.4g) mercurous chloride electrode, prepared by pressing a paste consisting of 85% mercurous chloride, 15% of acetylene black and an organic binder like carboxy methyl cellulose, polyvinyl alcohol. The pressure applied was 15 tons. The two electrodes are separated by means of single or multiple separator consisting of filter paper, cellophane paper, nylon cloth and the light materials. The cell is activated with 3% sodium chloride solution. The cell got activated in less than 1 minute on load. It operated between 1.5 and 1.3 volts, and gave about 90% energy output within 0.2 volts variation in the cell voltage at 5 hours rate. The cathodic material efficiency

is normally obtained between 95% and 90% at 6 hours discharge rate at 100 mA current drain. The cell was capable of being discharged at 2 hours and lower rates of discharges. Ampere hour capacity per unit volume is around 100 AH/dm³

Example 2

A cell similar to the one described in example 1 was assembled. The cell was activated with magnesium perchlorate as against sodium chloride solution used in experiment 1. The cell gave similar performance to the one described under Example 1 with the exception that the cell voltage was a little lower by an order 0.1V but the cathodic material efficiency was higher ranging between 97.5 and 95% at 6 hour discharge rate.

The following are the main advantages of the invention:

1. The cell is capable of high drain upto 2 hour rate discharge and therefore it can be used as heavy duty battery system for special applications as for automatic gun starter.
2. It operates within a narrow voltage range, say, 0.2V to deliver 90% of its capacity.
3. The cell system is much cheaper than magnesium-silver chloride, battery system which is presently used for naval applications because of its heavy drain characteristic like the one of Marker Unit and Life jackets.
4. The mercurous chloride is stabler chemically than cuprous chloride and so this cell system possesses longer shelf-life than magnesium-cuprous chloride.
5. The cell system constitutes a high energy density battery system.
6. The cell system is potentially useful for use as activated wet cell, dry cell as well as single shot cell.
7. The cell system gets activated in less than a minute on and off load and so it is extremely good as an activated battery system.


The present invention relates to a new battery system - magnesium-mercurous chloride - which hitherto is un-known. The advantages of high reversibility and constancy of the voltage of mercurous chloride half cell electrode gets incorporated in this battery device. The cell system includes a magnesium alloy anode, a mercurous chloride cathode which is made out of

mercurous chloride salt, a conducting material like acetylene black, a metal powder and a binder like carboxy methyl cellulose, polyvinyl alcohol and starch. The cell is capable of discharging a steady voltage at low and medium discharge rates.

WE CLAIM

✓ 1. A Magnesium-Mercurous Chloride depolarised battery comprising mercurous chloride cathode and magnesium anode and activated by inorganic electrolytes characterised in that the cathode is fabricated from a mixture of mercurous chloride, acetylene black and an organic binder such as polyvinyl alcohol, carboxymethyl cellulose, starch and the magnesium anode is magnesium or an alloy of magnesium.

Dated this 5th day of May, 1975.


Anil Kumar
PATENTS OFFICER,
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