

[54] **METHOD OF MAKING STRETCHABLE  
ZINC FIBERS**

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[58] Field of Search..... 164/82, 89, 281,  
164/283

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[57] **ABSTRACT**

A zinc fiber having a superior stretching ability, which is prepared through the steps of: melting an ingot metal having a zinc content of 99.6 percent or more, extruding the resulting melt through a nozzle having a bore diameter in the range of 20–250 $\mu$  by the use of an inert gas having a pressure in the range of 0.5–2.0 Kg/cm<sup>2</sup>, and cooling the resulting extruded fiber by contacting it with an air current flowing crosswise of the fiber at a speed of 3–5 m/sec, said zinc fiber consisting essentially of zinc, having a diameter in the range of 20–250 $\mu$  and having crystalline structure composed of crystals of zinc, the mean size of the crystals being substantially equal to the diameter of the fiber.

**1 Claim, No Drawings**

# METHOD OF MAKING STRETCHABLE ZINC FIBERS

## BACKGROUND OF THE INVENTION

### a. Field of the Invention

The present invention relates to a metallic zinc fiber which possesses a sufficient stretching ability and workability so that it can be made into strands and woven fabrics by the same spinning process as is used with a natural fiber.

### 2. Description of the Prior Art

A conventional method of manufacturing a metallic fiber in the prior art has been effected, for example, by casting a metal and extruding or rolling the casting by means of an extruding machine or a grooved-roll type rolling machine. According to this method, however, there is obtained only a coarsely drawn wire with a diameter of 0.5 mm at least. Therefore, the wire must be subjected to a further working employing wire-drawing dies in order to obtain a fiber of lesser diameter. Besides, in said working, a soft metal having a low melting point, such as zinc, which is made to pass through the dies, tends to adhere to the dies as it is heated by friction therewith at the time of passage, resulting in frequent breakage of the wire. Thus, it has been difficult to effect the industrial mass-production of a thin zinc fiber, especially, one having a diameter of less than 0.2 mm. Moreover, the fiber manufactured by this conventional method is of such quality that it has a stained surface due to the lubricant used in the wire-drawing dies and is apt to give rise to recrystallization due to the permanent set ascribable to the intense working, thereby resulting in a fiber composed of coarse crystals and having a poor stretching ability, whose performance can hardly be satisfactory either chemically or mechanically.

In view of these circumstances, we have made studies on a method for preparing a metallic fiber comprising subjecting a metal in molten state to an elevated pressure and making it flow out from a small orifice (hereinafter referred to as a melt-spinning process), and, by making good use of this process, we have found a method capable of industrial mass-production of a metallic fiber having a quality superior to the counterpart produced by the conventional mechanical method.

## SUMMARY OF THE INVENTION

The object of the present invention is to provide a stretchable zinc fiber consisting essentially of zinc, which fiber has a diameter in the range of 20–250 $\mu$  and possesses crystalline structure composed of zinc crystals whose mean size is substantially equal to the diameter of the fiber. The zinc fiber is prepared by subjecting an ingot metal having a zinc content of 99.6 percent or more to a melt-spinning process comprising the steps of melting the metal, extruding the resulting melt from a nozzle having a bore diameter in the range of 20–250 $\mu$  by the use of an inert gas having a pressure in the range of 0.5–2.0 Kg/cm<sup>2</sup>, and cooling the resulting extruded fiber by contacting it crosswise with an air current flowing crosswise of the fiber at a speed of 3–5 m/sec.

A zinc fiber having a great stretching ability can be obtained according to the present invention by an appropriate selection of the purity of zinc in the metal to be used, the bore of the nozzle, the outflow speed as well as the cooling speed of the melt, which are selected so that the diameter of a fiber resulting from the

melt-spinning process and the size of the zinc crystals are almost equal to each other. As to the purity of the metal to be used, it is necessary that the content of impurities should be as low as possible so as to make the crystals of zinc grow, and, accordingly, an ingot metal having a zinc content of 99.6 percent or more as prescribed by the Japanese Industrial Standard (JIS) is used for this purpose. The suitable diameter of the bore of the nozzle is in the range of 20–250 $\mu$ . The outflow speed of the melt is controlled by means of an inert gas, such as nitrogen, having a pressure of 0.5–2.0 Kg/cm<sup>2</sup>, and the cooling speed of the melt is regulated by means of, for example, blowing the air at a speed of 3–5 m/sec at a right angle to the flow, namely, the direction of extrusion of the melt.

The zinc fiber thus obtained possesses not only a sufficient stretching ability but also a clean surface and much activity because it is free from any adhering additives such as lubricants. Therefore, the zinc fiber according to present invention can be applied to various uses such as in the following.

1. Because of the sufficient stretching ability thereof, it can be worked into strands or manufactured into woven fabrics and is suitable for use in catalyst, electrode, etc.

2. It is capable being worked by elongation so as to reduce the diameter of the fiber.

3. Because its surface retains a clean and active state, it is capable of presenting better electrochemical behavior than a conventional rolled plate or powder when applied to the electrode a battery.

Given in the following is an example embodying the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

### EXAMPLE

An ingot metal having a zinc content of 99.6 percent and one having a zinc content of 99.99 percent were respectively melted at a temperature in the range of 430°–450° C, and then a pressure of 2.0 Kg/cm<sup>2</sup> nitrogen gas was applied to the respective melts in order to flow same out from a nozzle having a round section and being 0.25 mm and 0.12 mm in bore diameter, respectively. As a means for cooling, an air stream at a speed of 5 m/sec was blown at a right angle against the direction of the outflow of said melt, whereby the melt flown out was solidified at a position of 15–30 cm from the nozzle.

The mechanical properties of the resulting respective zinc fiber were as shown in the following table. As is apparent from the table, the product according to the present invention possesses a remarkable stretching ability compared with the counterpart prepared by the conventional rolling process of cast zinc or that prepared by another melt-spinning process.

| Kind of Fibers                               | Purity of metal employed (%) (as zinc content) | Diameter of fiber ( $\mu$ ) | Size of crystal ( $\mu$ ) | Stretching ability (%) |
|----------------------------------------------|------------------------------------------------|-----------------------------|---------------------------|------------------------|
| Fiber prepared by rolling cast zinc rod      | 99.99                                          | 8000                        | about 1000                | 20 ~ 30                |
| Zinc fiber prepared by another melt-spinning | 99.99                                          | 350                         | about 150                 | 5 ~ 10                 |

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|--------------------|-------|-----|-----------|-------|
| processs *         | 98.0  | 150 | about 75  | 5~7   |
| Zinc fiber accord- | 99.6  | 200 | about 200 | 15~20 |
| ing to the         |       |     |           |       |
| present invention  | 99.99 | 100 | about 150 | 50~70 |

Remark \* : Temperature for melting: 430°~450°C, pressure for extru-  
sion (by the use of pressured N<sub>2</sub> gas): 2 Kg/cm<sup>2</sup>, bore of nozzle: 0.4 mm  
dia. and 0.2 mm dia., method of cooling: forced-airdraft cooling (by  
blowing an air at a speed of 3~5 m/sec crosswise with the effluent of  
melt)

What is claimed is:

1. A method of manufacturing a stretchable zinc

fiber which comprises melting metal having a zinc con-  
tent of more than 99.6 percent, extruding the resulting  
melt through a nozzle having a bore diameter in the  
range of 20~250 $\mu$  by the use of an inert gas having a  
pressure in the range of 0.5~2.0 Kg/cm<sup>2</sup>, and then con-  
tacting the extruded melt with an air current flowing  
crosswise of the melt at a speed of 3~5m/sec thereby to  
cool same.

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