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METHOD OF GRINDING AN ALUMINUM-NICKEL ALLOY

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My invention is directed toward methods for producing electron emissive coatings.

A typical cathode structure for use in electron discharge tubes comprises a hollow cathode sleeve or cylinder formed of a base metal, for example, nickel. The outer surface of the sleeve is covered with an electron emissive layer or coating composed of a mixture of various alkaline earth metal carbonates as, for example, the carbonates of barium, strontium and calcium. A heater element is inserted within the sleeve. When the heater is electrically energized and the cathode is heated to a suitable temperature, electrons are emitted from the layer.

It is known that when a small amount of one or more metal activators is alloyed with the base metal in the sleeve, to form what is known to the art as an active alloy, the resultant cathode is a better electron emitter. See for example my copending application, Serial No. 284,931, filed April 29, 1952, when aluminum is used as an activator. Other metals such as chromium and magnesium are also used as activators.

The electron emissive properties of cathode structures can likewise be improved by incorporating the active alloy in the electron emissive coating rather than in the sleeve itself.

This process is particularly advantageous when, for example, the heater element is formed from tungsten, for if metal activators are incorporated into the sleeve itself, the cathode structure is adversely affected. In particular, the heater-cathode leakage is appreciably increased.

In one process for incorporating an active alloy in the electron emissive coatings, an active alloy powder is mixed into a suspension of alkaline earth metal carbonates by grinding the powder and the suspension together in a ball mill.

Conventional ball mills are lined, for example, with porcelain or silex. The grinding media consists of flint or porcelain pebbles or balls. Consequently, both the grinding media and the mill lining contain silica; and when the active alloy powder and the carbonate suspension are ground together in this type of ball mill, some of the silica is worn away from the lining and pebbles and is incorporated as an impurity into the suspension. When such a silicon containing suspension is applied to the cathode sleeve and subsequently heated to form the final electron emissive coating, the silica forms slags and interfacial compounds which result in impaired emission.

Accordingly, it is an object of the present invention to improve the process in which active alloy powders and suspensions of alkaline earth metal carbonates are ground together in a ball mill in such manner that no impurities are incorporated into the suspension.

Another object is to provide a new and improved process for grinding active alloy powders and suspensions of alkaline earth metal carbonates together in a ball mill in such manner as to prevent silicon contamination of the suspension.

Still another object is to provide a new and improved process for ball milling an active alloy powder into a suspension of alkaline earth metal carbonates without adding impurities to the suspension.

These and other objects will either be explained or will become apparent hereinafter.

In my invention, a ball mill is lined with the base metal component of an active metal alloy. The grinding media (for example balls or pebbles) is formed from the alloy itself. A suspension, for example, an aqueous suspension, of alkaline earth metal carbonates is then ground in the ball mill. In the grinding process, some of the active alloy is worn away from the grinding media and is incorporated into the suspension. Since there is substantially no silica or other similar impurity present in the lining, grinding media or the suspension itself, the resultant active alloy bearing suspension is necessarily free from such impurities.

In one specific embodiment of my invention, the ball mill is lined with nickel and the grinding media is formed from balls composed of an aluminum-nickel alloy, the aluminum being present in an amount of approximately 1% by weight.

Alternatively, the ball mill can be lined with the aluminum nickel alloy and the balls can be formed from nickel.

However, since the grinding balls are worn away much more rapidly than the lining, and since it is far easier to add additional balls periodically rather than to reline the ball mill itself, it is preferable to have the balls composed of the active alloy and the lining composed of the base metal component (nickel) of this alloy.

Obviously, such parameters as the size and composition of the balls, the types of carbonate suspensions and the length of the grinding operation can be varied as necessary in a manner well known to those skilled in the art.

I have found, however, that an electron emissive coating containing controlled amounts of the nickel aluminum alloy and substantially free from silica and other similar impurities can be obtained through the use of an active alloy bearing alkaline earth carbonate suspension formed by grinding conventional aqueous suspension of double or triple carbonates in a nickel lined ball mill for a period of several hours, the grinding elements being composed of the above described aluminum-nickel alloy and having an average diameter of one half inch.

While I have shown and pointed out my invention as applied above, it will be apparent to those skilled in the art that many modifications can be made within the scope and sphere of my invention as defined in the claims which follow.

What is claimed is:

1. A method for adding an aluminum nickel alloy to an aqueous suspension containing at least one alkaline earth metal carbonate, said method comprising the step of contacting said suspension with grinding media in a ball mill, the inner surface of said mill being lined with nickel, said grinding media being composed of said alloy.

2. A method as set forth in claim 1 wherein the aluminum content of said alloy is on the order of 10%.

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