

[54] **METHOD OF ELECTROCOATING A HEATING MEMBER WITH A DARK-COLOURED INSULATING LAYER AND HEATING MEMBER FOR AN INDIRECTLY HEATED CATHODE MANUFACTURED BY SAID METHOD**

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[22] **Filed:** June 29, 1972

[21] **Appl. No.:** 267,577

[30] **Foreign Application Priority Data**

July 3, 1971 Netherlands 7109224

[52] **U.S. Cl.**..... 204/181, 117/231, 117/218
 [51] **Int. Cl.**..... B01k 5/02; C23b 13/00
 [58] **Field of Search**..... 204/181; 117/231, 117/218

[56] **References Cited**
UNITED STATES PATENTS

2,800,446	7/1957	Fredenburgh.....	204/181
3,024,184	3/1962	Bowes et al.....	204/181

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[57] **ABSTRACT**

A black second layer containing xylene, petrol and tungsten powder is provided on an unsintered first insulating layer of aluminium oxide and polyvinyl acetate of a filament of an indirectly heated cathode.

4 Claims, No Drawings

METHOD OF ELECTROCOATING A HEATING MEMBER WITH A DARK-COLOURED INSULATING LAYER AND HEATING MEMBER FOR AN INDIRECTLY HEATED CATHODE MANUFACTURED BY SAID METHOD

The invention relates to a method of covering a heating member for an indirectly heated cathode with an insulating layer which is dark-coloured at the surface, in which a dark-coloured layer is provided on an unsintered insulating layer after which both layers are simultaneously heated and sintered. The invention furthermore relates to a heating member manufactured by means of said method.

It is known from German Patent Specification 1,281,038 to provide a dark-coloured tungstic acid-containing layer on an unsintered insulating layer of a heating member. The unsintered insulating layer comprises a binder to prevent tungstic acid from penetrating into the unsintered insulating layer. It is furthermore known from Germ. Patent Specification 1,134,766 to add silicates to the insulating layer so as to reduce the sintering temperature. A dark layer comprising alkali silicates was provided on the unsintered insulating layer.

Furthermore it was known from French patent specification 1,355,710 to provide a black zirconium oxide-containing layer on an unsintered aluminium oxide layer and to add collodium to both layers as a binder. In this known method, the two layers were simultaneously sintered.

It has been found, however, that the known methods exhibit drawbacks, since the adhesion of the layers often is not sufficient so that they break or work loose if the heating wire in the further processing is bent, while the solvent of the dark layer can also partly dissolve the binder of the previously provided insulating layer, so that the lower layer can be damaged, while the parts of the dark layer, usually consisting of metal, can penetrate into the insulating layer as a result of which the insulation resistance becomes smaller.

A very favourable method of covering a heating member for an indirectly heated cathode with an insulating layer which is coloured dark at the surface, in which a dark-coloured second layer is provided on an unsintered first insulating layer consisting of a suitable metal oxide and a binder, after which both layers are simultaneously heated and sintered, is obtained, if according to the invention, the metal oxide and the binder of the first layer are both provided electrophoretically on the heating wire, after which on said first layer is provided a second layer of a suspension containing a darkcoloured material and a suitable metal oxide in a finely divided condition, a solution of a binder, a solvent for the binder present in the first layer, and a material which hampers the action of said solvent on the binder in the first layer.

The first layer may consist of an oxide of aluminium, magnesium or beryllium with polyvinyl acetate as a binder, which materials are both provided by electrophoresis from methanol on a filament which, for exam-

ple, is helically wound. On this first layer a dark-coloured second layer is provided consisting of a suspension containing:

600 g of Al_2O_3 powder (particle size smaller than 8 μ),

900 g of tungsten powder (average particle size 1.5 to 3 μ),

410 ml of polymetacrylate solution (400 g of polymetacrylate in 1000 ml of petrol of boiling point between 100°C and 140°C),

700 ml of xylene,

1100 ml of petrol (having a boiling range between 100° and 140°C).

The petrol prevents the xylene from attacking the binder of the first layer too considerably, as a result of which the first layer would soften and mixing and damage of the layers could occur. A certain action, however, is necessary to obtain a good adhesion between the first layer and the dark second layer. The ratio of the quantities of petrol and xylene may be between 7:3 and 1:1. A suitable value is 3:2.

If no xylene is added, a poor adhesion occurs between the layers; if too much xylene is added, the first layer softens and mixing and damage of the layers can occur.

The particle size distribution of the metal oxide present in the suspension for the dark-coloured second layer preferably is: 14 percent smaller than 1 μ , 100% smaller than 8 μ .

Instead of the aluminium oxide, the oxide of thorium (ThO_2), beryllium (BeO), zirconium (ZrO_2) or magnesium (MgO) may be used in said suspension.

What is claimed is:

1. A method of covering a heating member for an indirectly heated cathode with an insulating layer which is dark coloured at the surface, in which a dark-coloured second layer is provided on an unsintered first insulating layer consisting of a suitable metal oxide and a binder, after which both layers are simultaneously heated and sintered, characterized in that the metal oxide and the binder of the first layer are both provided electrophoretically on a heating wire, after which on said first layer is provided a second layer of a suspension containing a dark-coloured material and a suitable metal oxide in a finely divided condition, a solution of a binder, a solvent for the binder present in the first layer, and a material which hampers the action of said solvent on the binder of the first layer.

2. A method as claimed in claim 1, characterized in that the binder of the first layer consists of polyvinyl acetate, the solvent for said binder present in the second layer is xylene and the material which hampers the action of the xylene on the polyvinyl acetate is petrol having a boiling range between 100° and 140°C.

3. A method as claimed in claim 1, characterized in that the volume ratio of the quantities of petrol and xylene lies between 7:1 and 1:1 and preferably is 3:2.

4. A heating member comprising a first insulating layer and a dark second layer provided by means of the method as claimed in claim 1.

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