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[54] **X-RAY TUBE TARGET AND X-RAY TUBES UTILISING SUCH A TARGET**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **313/55;** 117/217; 117/221; 117/228; 313/60; 313/330

[51] **Int. Cl.** **H01j 35/10**

[58] **Field of Search** .... 117/217, 228, 71 R, 221; 313/330, 55, 60; 204/192

[56] **References Cited**

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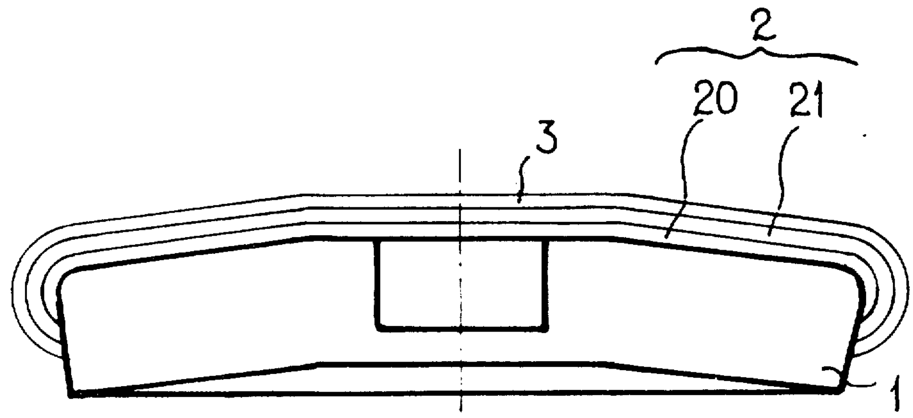
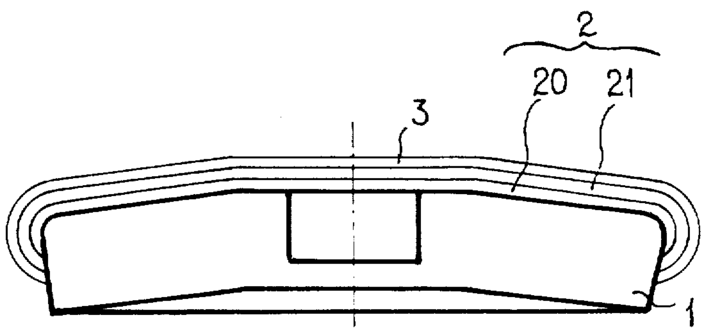
[57] **ABSTRACT**

The present invention relates to a graphite target for X-ray tubes. In order to avoid the drawbacks of graphite carrier (1) targets due to transformation into carbide of the photo-emissive coating (3) by the carrier material, the invention provides for the formation of the intermediate layer (2) in these targets, in the shape of two sub-layers one of which (**20**), in contact with the carrier, is made of a refractory material which does not form a carbide (iridium for example), and the other of which (**21**) is made of another refractory material (tantalum for example), which prevents diffusion of carbon from the carrier into the emissive layer.

2 Claims, 1 Drawing Figure

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X-RAY TUBE TARGET AND X-RAY TUBES UTILISING SUCH A TARGET

BACKGROUND OF THE INVENTION

a. Field of the Invention

The present invention relates to a target for X-ray tubes, more particularly a rotating target, and to the X-ray tubes utilising such a target.

b. Discussion of the Prior Art

Targets are known which are constituted by a carrier or base of graphite, to which there is applied an emissive layer producing an X-ray stream under the impact of electrons coming from the tube cathode.

Amongst the various elements of high atomic number which can be used for the emissive layer, tungsten is particularly advantageous and is often given preference. However, a tungsten layer applied directly to the graphite carrier, at the temperatures encountered during operation, undergoes a chemical reaction with the carbon of the carrier and is quickly transformed to tungsten carbide throughout its thickness; the carbide layer thus formed becomes detached from the carrier.

Solutions which are designed to overcome this drawback, are already known from the prior art.

Thus, it has been proposed that there be arranged between the carrier and the tungsten layer, an intermediate tantalum layer which is transformed to a carbide; the layer of tantalum carbide thus formed prevents diffusion of the carbon and thus prevents the formation of tungsten carbide. However, the fragility of the tantalum carbide means that the assembly becomes detached from the carrier because of the differences in coefficient of expansion. Again, it has been proposed that an intermediate layer of rhenium be used. Rhenium does not form a carbide but, with carbon and at 2480°C, it forms a eutectic structure containing **16.9** carbon atoms percent. Tungsten carbide forms by contact between the tungsten and this carbide-rich alloy. The rhenium layer is therefore ineffective in preventing the formation of tungsten carbide.

SUMMARY OF THE INVENTION

The object of the present invention is to improve targets of the kind hereinbefore described. More precisely, the invention relates to a target structure for X-ray tubes, on a graphite base, which prevents too rapid transformation to carbide on the part of the emissive layer and gives the tube a long surface life.

To this end, the invention provides for the arrangement between the carrier or base, and the emissive layer, of an intermediate layer made up of two sub-layers as described hereinafter.

According to the invention there is provided a target for X-ray tubes, constituted by a carrier of graphite and an emissive layer made of a refractory metal having a high atomic number, covering said carrier and the two layers being separated by an intermediate layer, characterised in that said intermediate layer is constituted by two sub-layers one of which, that in contact with the carrier and referred to as the first sub-layer, is made of a refractory material which does not form a carbide and is in contact with the carrier, and the other of which, that is the second sub-layer, is in contact with the emissive layer and made of another refractory material.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE illustrates an embodiment of a target in accordance with the invention:

DESCRIPTION OF THE PREFERRED EMBODIMENTS

On a graphite carrier **1**, there are successively deposited a sub-layer **20** of a refractory metal which does not form a carbide and then, on this first sub-layer, a second sub-layer **21** of another refractory metal. These two sub-layers constitute the intermediate layer **2**. On this latter, there is then deposited the emissive layer of refractory metal, **3**.

In a preferred embodiment of the invention, the sub-layer **20** is constituted by iridium, the sub-layer **21** by tantalum, and the emissive layer **3** by tungsten.

These different metals are deposited upon the carrier **1** by any known prior art method, for example:

in the case of iridium, by cathode-sputtering to a thickness of around 50 μm;

in the case of tantalum, by chemical reaction in the vapour phase, between the chloride and a hydrogen flow at a temperature T at least equal to 1000° C and at a pressure P of less than or equal to 1 torr, this in order to avoid any hydride formation; an example of the conditions employed is given below:

$P = 1$ torr
$T = 1100°C$
$T_{TaCl_5} \sim 200°C$
hydrogen flow = 100 cm^3/mn
thickness of deposit: 50 μm

in the case of tungsten, by chemical reaction of the gaseous fluoride with a hydrogen fow, under the following conditions:

$P = 10^{-3}$ torr
$T = 1300°C$
Ratio $H_2/WF_6 = 3$
thickness of the layer: 500 μm

During the initial operation of the tube, carbon diffuses across the iridium and reacts with the tantalum, transforming the tantalum to tantalum carbide which will not allow the diffusion of carbon and prevents the formation of tungsten carbide.

The adhesion of the tantalum carbide to the graphite is ensured because of the plasticity of the iridium sub-layer which takes up the effect of the difference in coefficient of expansion.

In other variant embodiments, it is possible to use a sub-layer **20**, instead of iridium other elements such as osmium and ruthenium, and for the sub-layer **21**, instead of tantalum, other elements such as hafnium, niobium or zirconium.

Of course, the invention is not limited to the embodiment described and shown which was given solely by way of example.

What we claim is:

1. A target for X-ray tubes constituted by a carrier of graphite and an emissive layer made of tungsten covering said carrier and being separated by an intermediate layer, said intermediate layer is constituted by two sub-layers one of which is in contact the carrier and is made of an element selected from the group consisting essentially of iridium, osmium and ruthenium, and the other in contact with the emissive layer is made of an element selected from the group consisting essentially of hafnium, niobium, tantalum and zirconium.

2. An X-ray tube comprising target means for producing X-rays when impacted by electrons, cathode means for generating electrons, said target means including a carrier of graphite and an emissive layer made of tungsten covering said carrier and being separated by an intermediate layer, said intermediate layer is constituted by two sub-layers, one of which is in contact with the carrier and is made of an element selected from the group consisting essentially of iridium, osmium, and ruthenium, and the other is in contact with the emissive layer is made of an element selected from the group consisting essentially of hafnium, niobium, tantalum, and zirconium.

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