United States Patent Office

3,197,847

Patented Aug. 3, 1965

3,197,847

CLAD MATERIALS AND PROCESS OF FABRICATING THE SAME

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No Drawing. Filed Apr. 27, 1961, Ser. No. 105,892

5 Claims. (Cl. 29—182.3)

This invention relates to the process of making a metal laminate and the product resulting from the mode of manufacture.

It has been the practice to produce laminated metal structures by many techniques including drag coating the base metal through a liquid containing a binder and particles of the metal to be deposited thereon. The base, which is covered with the binder and deposited metal particles, is subsequently heated to drive off the binder and sinter the particles together. It has been found that such a process does not produce a coating or laminae which is uniform in thickness or density, nor can the metal particles be homogeneously and contiguously deposited relative to one another. In addition there is little if any diffusion of the metal particles into the base metal. This latter feature is important where some controlled alloy characteristics such as strength are desired in the end product.

Accordingly, it is an object of the invention to reduce the aforementioned disadvantages by improving the application of metal particles to a base metal.

Another object of the invention is to clad a metal base with an improved thin substantially impenetrable layer, particularly where the layer is of refractory metal.

Yet another object of the invention is to produce an improved clad metallic structure or fabric.

Other objects will become apparent after consideration of the following specification and claims.

In carrying out the method of this invention, a curved or flat strip of metal or wire is coated with a film of metal dispersed in a combustible binder and the metal of the film is sintered onto the strip or wire. Since the process is the same for whatever form the metal base may partake, subsequent description, for simplification, will refer to the metal coated as a strip although it is obvious the strip may find its equivalent in wires, tubes or the like.

The film is of the type disclosed in the application of Donald R. Kerstetter and Samuel J. Montgomery for "Powdered Metal Films," Serial No. 105,891 filed of even date herewith, to which reference may be had for further disclosure, and it may be applied to a metal base by the method disclosed in Patent No. 2,986,671, Kerstetter and Wennin, for Application of Strip Coating to Cathodes (on an application, S.N. 453,235, filed August 31, 1954). In general, the film comprises an organic binder with about 75 to 97%, by weight of the film, of metal powder of 7μ–9μ particle size distributed homogeneously throughout the film with the particles in contact with one another. After the film has been applied to the metal base, the whole is sintered at a temperature amenable to the metal base resulting in a sintered mass, the sintered particles of which are uniformly distributed over the base metal. If desired, the sintered mass can then be rolled to secure compacting of the sintered particles, to secure penetration of the metal particles in the film into the metal base, and to secure the desired overall thickness of the laminate.

The above method of producing clad metals or laminates is particularly useful where refractory metals such as tungsten or molybdenum are employed in the film. The film itself, as explained in detail in the above Kerstetter application, is formed from a viscous mass or slurry of metal powder in an organic binder. The organic binder is dissolved in an organic solvent mixture, and the mass is cast on a moving surface and partially dried thereon. Subsequently, the film so formed or cast is stripped therefrom, after which the solvent is wholly evaporated. Sufficient plasticizer is embodied within the slurry to maintain the resulting film pliable for subsequent handling.

Where thin cladding of a metal base is desired, as a covering of tungsten on a ductile nickel base which is adaptable for use as a cathode sleeve or as a directly heated cathode filament in an electron tube, a ductile nickel strip, .005" thick, may be coated by the process set forth in the above referred to disclosures with a film approximately .002" thick containing about 90% tungsten powder, by weight of the film. The tungsten particles of the powder may be of the order of 3μ to 9μ in size, the smallest size being preferred. This film, when sintered onto the nickel base, yields a tungsten film of about 35% density and a thickness of about .0015". Upon rolling this laminated fabric to .002", the tungsten laminae has a thickness of about .0005" or less and the density is compacted to between 95% and close to 100%. Obviously, under the condition outlined, there is a considerable amount of diffusion of the metals into each other which results in conversion, at least in part, of the ductile cathode base nickel into a tungsten nickel alloy. Thus, where a cathode sleeve is to be fabricated, it can be very easily formed from the sintered nickel tungsten laminated sheet into an oval or cylindrical or rectangular sleeve. This cathode sleeve may then be heated and annealed to form a hard rigid sleeve which, when coated with emissive material, is suitable for use in electron tubes. If desired, the tungsten film may be applied to the nickel on one or both sides thereof.

The process disclosed above may be used to produce many types of laminated structures in strip or wire form which are made from various metals and have various densities and various alloy characteristics. For instance, it has been found that laminates having carefully controlled predictable characteristics can be made from combinations of certain ones of such metals as aluminum, iron, steel, copper, molybdenum, etc. as well as the nickel and tungsten laminate described above as one specific example of the invention.

Although several embodiments of the invention have been described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

What is claimed is:

1. A laminated structure comprised of a base metal and an overlying pliable cast film strip comprising a binder and a metal powder with contiguous particles, the particles being homogeneously distributed in the binder.

2. The process of forming a laminated metal fabric comprising the step of applying a self-supporting pliable film strip embodying metal powder in a combustible binder to a metal base, the metal powder film strip having particles in contiguous relationship in the binder and homogeneously distributed throughout the binder, and the step of sintering the powder particles to each other and to the metal base.

3. The process of forming a laminated metal fabric comprising the step of applying a self-supporting pliable film strip embodying metal powder in a combustible binder to a metal base, the metal powder film strip having particles in contiguous relationship in the binder and homogeneously distributed throughout the binder, the step of sintering the particles to each other and to the base metal, and the step of rolling the thus formed laminate to produce a laminate of high surface density and required thickness.

4. The process of forming a laminated metal fabric comprising applying to a nickel base a self-supporting pliable film strip containing an organic binder and tungsten powder particles with the film strip particles of powder approximately in the range of 75 to 97% of the weight of the film and sintering the particles to each other and to the nickel base.

5. The process of forming a laminated metal fabric comprising applying to a nickel base a self-supporting pliable film strip containing an organic binder and tungsten powder particles with the film strip particles of powder approximately in the range of 75 to 97% of the weight of the film, sintering the particles to each other and to the nickel base, and rolling the laminate thus formed to a desired thickness and density of the sintered tungsten.

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