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METHOD OF TREATING COMPOSITE METAL

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This invention relates to sprayed metal and is particularly concerned with a method for strengthening sprayed metal layers and thereby greatly improving the physical characteristics thereof.

The prime purpose of this invention is to improve the physical characteristics of a sprayed metal layer and in some cases to improve the bond between said sprayed metal layer and a stronger solid metal backing.

In carrying out this object, it is a further object to reduce and in some cases eliminate the lamellar or micaceous structure of sprayed metal layers.

Another object of the invention is to provide a method for homogenizing sprayed metal layers for improving the bond between adjacent particles of sprayed metal and in some cases for improving the bond between the sprayed metal and a solid metal backing member.

A still further object of the invention is to provide a heat treating step for sprayed metal layers wherein the strength under tension of the sprayed metal is greatly increased.

Further objects and advantages of the present invention will be apparent from the following description.

When metal is sprayed, for example, from a "Schori" gun or a "Shoop" gun, a wire of the metal is melted in an oxyacetylene flame and through the use of compressed air small particles of the metal in molten condition are thrown outwardly against any suitable receiving object. In some cases, it is desirous to build up bearings from sprayed metal wherein a steel backing is utilized as the receiving member and wherein metal of a suitable character is sprayed thereagainst whereby a bearing layer of the desired metal is built up on the steel backing. Since the particles of metal being thrown off by the gun are in a molten condition and since the compressed air throws these particles with considerable force against the metal backing, the particles upon impingement and deposition assume a lamellar or micaceous shape. This is to say, the sprayed metal layer is built up of a multiplicity of leaf-like plates very similar to the structure of mica. Furthermore, since the metal already sprayed cools almost instantaneously, the next particle of molten metal to be deposited does not always bond thereto with a strong bond. It has been noted that sprayed metal layers are strong in compression but are generally weak under tension, flaking off in plate-like layers or particles. Likewise, the bond between the sprayed metal and the steel or other solid metal is poor in most cases.

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In order to correct these disadvantageous factors and make the sprayed metal layer more suitable for a bearing and more strongly bonded to the steel backing, I propose to homogenize the sprayed metal layer. This may be easily accomplished by passing the layer on the steel through a suitable heat treating furnace for a period of time sufficient to heat up the entire sprayed metal layer to a temperature slightly below its melting point. This heating should be carried out under non-oxidizing conditions and the sprayed metal layer after sufficient heating should be cooled under non-oxidizing conditions to room temperature.

In carrying out these steps, I propose to heat the sprayed metal layer for a period of from 15 minutes to an hour at a temperature slightly below its melting point in an atmosphere of hydrogen, nitrogen, carbon monoxide or in any of the commercial protective atmospheres such as, incompletely burned natural gas.

For an illustrative purpose only the following example is given: Bronze may be sprayed upon the surface of a steel backing member to form a layer of suitable thickness after which the layer on the steel backing member is passed through a furnace at a temperature between 1400 and 1500° F. for a period of 30 minutes wherein the atmosphere of the furnace is preferably incompletely burned natural gas with a minimum of water vapor therein. The temperature may vary and should be preferably below the liquidus temperature of the alloy, however, in cases where only a very small quantity of low melting constituent is present this temperature may be exceeded, the major factor being that the layer of sprayed metal remains physically intact during the heating step and that no apparent melting is noticeable. It has been found that this treatment homogenizes the bronze layer through diffusion of adjacent particles whereby the bonds between the particles are improved and strengthened and wherein the bond between the sprayed metal layer and the steel is improved. In many instances, it may be desirable to copper-plate the steel prior to spraying the metal thereon whereby this copper layer diffuses into the steel and into the bronze layer upon homogenization thereon. It will be noted that the bronze preferably a 90–10 copper-tin bronze, melts in the neighborhood of 1832° F. so that the homogenizing temperature is substantially below the melting point. After cooling, it will be found that the bronze layer is considerably stronger under tension and has a

considerably better degree of adhesion to the steel backing member.

It is apparent that any of the metals that may be sprayed may be treated in a like manner, for example, copper, copper-nickel alloys, brass, aluminum, aluminum alloys, iron, silver or any of the other conventional metals or alloys thereof. In each case, the temperature of homogenization should be carefully selected below the melting point of the metal or alloy being treated. Similarly numerous backing materials may be utilized such as, steel, iron, copper, bronze, nickel or alloys thereof. In these instances, care should be taken that the homogenization temperature is also below the melting point of the backing metal. In all instances, heating of the sprayed metal at a temperature below its melting point will improve physical characteristics, relieve strains, if any are apparent and in general make a more desirable material.

In some cases it is desirable to roughen the surface of the metal backing prior to the deposition of the sprayed metal layer thereon. This may be done by any of the conventional methods such as, sand blasting, grit blasting or acid treatment such as, acid pickling and spraying. This roughened surface as a rule will increase the strength of the bond between the sprayed metal layer and the strong metal backing also increased strength may be obtained by heating the sprayed metal layer under pressure wherein the sprayed metal layer is in effect hot worked by means of pressure rolls within the furnace while the sprayed metal layer is in a heated condition. This operation not only increases the strength of the sprayed metal layer but improves the bonding of the layer to the strong metal backing.

It is apparent that in all cases the operation may be carried out either continuously or intermittently, that is to say, the sprayed metal may be put on a strip of steel or the like which is passed through the furnace or it may be sprayed on individual backing members which may likewise be passed through the furnace.

It is manifest that while the foregoing disclosure is directly mainly to bearing structures, that this method of strengthening sprayed metal may be advantageously used in any application wherein improved physical characteristics of the sprayed metal are desired.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a method for improving the physical characteristics of a sprayed copper layer, that step of homogenizing the layer by a heat treatment operation on the layer at a temperature of between 1600 to 1900° F. so as to prevent any melting for a period of time sufficient to cause substantial bonding to occur between adjacent particles of copper, said heating step taking place under non-oxidizing atmospheric conditions.

2. In a method for improving the physical characteristics of a sprayed bronze layer, that step of homogenizing the layer by a heat treatment operation on the layer at a temperature between 1400 and 1500° F. so as to prevent any melting for a period of time sufficient to cause substantial bonding to occur between adjacent particles of bronze, said heating step taking place under non-oxidizing atmospheric conditions.

3. In the method for improving the physical characteristics of composite bearing stock consisting of a supporting back of a strong metal having a sprayed metal layer thereon which layer includes a high percentage of copper the steps of; heating the high copper layer at a temperature above 1400° F. and below any liquidus temperature of the components of the high copper layer for a period of time sufficient to homogenize the sprayed high copper layer and to improve the bond between the sprayed layer and the supporting back, said heating step being carried out under non-oxidizing atmospheric conditions, and then cooling the composite bearing stock under non-oxidizing atmospheric conditions whereby the strength of bond and the physical properties of the sprayed layer are improved.

4. The steps in the method of making a bearing blank including a strong metal supporting back and a layer of a cupreous bearing metal integrally bonded thereto comprising, cleaning the bearing blank of all oxides and dirt and grease, spraying a layer of a cupreous bearing metal having a lower melting point than the bearing blank in an appreciable thickness upon a surface of said blank, heating the blank with the layer of bearing metal thereon at a temperature above 1400° F. and less than any liquidus temperature of the sprayed cupreous metal layer for causing homogenization of the sprayed metal layer and for causing an appreciable diffusion of the sprayed metal layer into the bearing blank at their juxtaposed surfaces, and then cooling the composite homogenized blank, said heating and cooling steps taking place under non-oxidizing atmospheric conditions.

5. In the method of improving the physical characteristics of composite metallic articles, the steps of; providing a strong metal support having a copper plated surface thereon, spraying a layer of high copper material on the plated surface of the support, heating the composite article so formed to a temperature above 1400° F., and below any liquidus temperature of the sprayed metal layer whereby the sprayed metal layer and the plated layer are diffused one into one another and into the supporting back without any melting, and then cooling the composite article, said heating and cooling steps taking place under non-oxidizing conditions of atmosphere.

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