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METAL COMPOSITION

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This invention relates to a metallic composition and the manufacture thereof.

It is an object of the invention to provide a material which will have useful properties for many applications and which will be particularly suitable for electrical contacting members.

It is a further object of the present invention to provide an improved contacting material which will withstand severe loads without disintegration.

It is a further object of the invention to provide a new metal composition and combination of metallic elements, resulting in a product of great cohesion.

Other objects of the invention will be apparent from the following description, taken in connection with the appended claims.

The present invention comprises the combination of elements, methods of manufacture and the product thereof, brought out and exemplified in the disclosure hereinafter set forth, the scope of the invention being indicated in the appended claims.

While a preferred embodiment of the invention is described herein, it is contemplated that considerable variation may be made in the method of procedure and the combination of elements, without departing from the spirit of the invention.

The invention contemplates the provision of a metallic body consisting of a carbide of a refractory metal taken from the fourth, fifth or sixth group of the periodic system, and cobalt and silver.

The complete composition may contain the combined ingredients in the following permissible ranges of proportions:

	Per cent
Carbides of metal selected from the group consisting of titanium, zirconium, vanadium, columbium, tantalum, molybdenum and tungsten	35 to 70
Cobalt	.25 to 15
Silver	25 to 64

The preferred carbides are tungsten carbide and molybdenum carbide.

The selection of the preferred composition to be used for any purpose will, of course, depend upon the specific properties desired such as degree of hardness, electrical conductivity and contact resistance, toughness and the like for the particular application contemplated.

If high electrical conductivity is desired it is preferred that the silver shall predominate and under these conditions the most desirable range of compositions is as follows:

	Per cent
Refractory metal carbide	35 to 49
Cobalt	.25 to 15
Silver	50 to 64

On the other hand if a contact material is desired which will have little tendency to welding or sticking under high current carrying conditions, such as heavy duty contacts, pressure exerting welding electrodes and the like, the following range of proportions is preferred in which the refractory metal carbide predominates:

	Per cent
Refractory metal carbide	50 to 70
Cobalt	.25 to 15
Silver	25 to 49

The following are specific examples of preferred compositions:

	Per cent
A. Refractory metal carbide	40
Cobalt	2
Silver	58
B. Refractory metal carbide	65
Cobalt	1
Silver	34
C. Refractory metal carbide	50
Cobalt	6
Silver	44
D. Refractory metal carbide	60
Cobalt	12
Silver	28

In all of the above cases tungsten carbide and molybdenum carbide are the most important and are generally preferred. However, the other carbides previously mentioned all result in satisfactory compositions, titanium carbide and zirconium carbide being very useful.

In some cases silver base alloys containing added ingredients which are not subversive to the desirable characteristics of the silver in the compositions described may be used in place of silver and it is contemplated that the term "silver" shall be construed broadly enough to cover both pure silver and sterling silver. Sterling silver is sliver containing a relatively small proportion of copper which does not materially lower the electrical conductivity or adversely affect other properties such as low contact resistance, low material transfer and the like when used for electric contact purposes.

A large number of tests have been made upon various compositions prepared according to the

present invention and it has been found that the compositions of refractory metal carbides, silver and cobalt coming within the scope of the present invention gave consistently better performance as contacts than compositions containing no cobalt.

The compositions of the present invention may be prepared by mixing the refractory metal carbide powders with cobalt powder, then adding a binder such as 1% by weight of resin to facilitate pressing of the mixed powders. The materials are then pressed into suitable shapes at relatively high pressure, the pressure depending upon the degree of porosity or density required. The pressed slugs are then sintered at suitable temperatures such as 1100–1400° C. and for suitable periods such as 10 to 30 minutes in inert or reducing atmospheres. The sintered slugs are subsequently alloyed or impregnated with silver by placing a sufficient quantity of silver upon the sintered pieces and heating to a temperature above the melting point of silver to cause fusion of the silver and absorption of the molten silver into the voids in the sintered place due to capillary action.

It is also possible to mix the silver powders directly with the powdered refractory metal carbides and cobalt powders and press the thoroughly mixed powders either cold or at elevated temperatures into suitable shapes with or without a subsequent sintering operation at a suitable temperature, preferably close to the melting point of silver, namely 960 degrees C. Such compacts may also be further strengthened by applying a coining operation or cold forming operation after sintering.

It is also possible to add additional steps to the manufacturing process such as additional sintering and pressing operations at suitable stages in the procedure so as to improve the strength or density of the material.

The composition produced in the manner described are susceptible to hot or cold forming operations. The hot working operations may comprise swaging, rolling, forging or drawing. It is advisable to use a small reduction in area followed by annealing after which the reductions in area may become progressively greater.

As an example of the manufacture of specific compositions we may refer to certain compositions which we have made up, in one of which 0.5% of cobalt powder was mixed with 99.5% of tungsten carbide powder. This composition was pressed until it had a pressed density of approximately 8 to 8.2 grams per c. c. and was then sintered at 1200 degrees C. The density after sintering was found to have increased to approximately 8.6 grams per c. c. The pieces were then impregnated with silver at a temperature of 1300 degrees C. The resulting density was found to be approximately 13.4 grams per c. c. with a hardness of 34 to 39 Rockwell C. The electrical conductivity was 34% and the silver content in the finished samples about 30%. Other compositions were made up in which 1% cobalt was mixed with 99% tungsten carbide powder and in another of which 2% cobalt was mixed with 98% of tungsten carbide, the rest of the procedure being substantially the same as described and the results being quite similar.

While the present invention, as to its objects and advantages, has been described herein as carried out in specific embodiments thereof, it is not desired to be limited thereby but it is intended to cover the invention broadly within the spirit ann scope of the appended claims.

What is claimed is:

1. An electric contacting element formed of a metal composition composed of 35 to 70% of refractory metal carbide selected from the group consisting of the carbides of titanium, zirconium, vanadium, columbium, tantalum, molybdenum and tungsten, .25 to 15% cobalt and 25 to 64% silver.

2. A metal composition comprising about 60% of refractory metal carbide selected from the group consisting of the carbides of titanium, zicronium, vanadium, columbium, tantalum, molybdenum and tungsten, about 12% cobalt and about 28% silver.

3. A metal composition comprising about 40% of refractory metal carbides selected from the group consisting of the carbides of titanium, zirconium, vanadium, columbium, tantalum, molybdenum and tungsten, about 2% cobalt and about 58% silver.

4. A metal composition comprising about 65% of refractory metal carbides selected from the group consisting of the carbides of titanium, zirconium, vanadium, columbium, tantalum, molybdenum and tungsten, about 1% cobalt and about 34% of silver.

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