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METAL COMPOSITION

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This invention relates to powder metal compositions and articles made therefrom.

An object is to improve metal powder compositions.

Another object of the invention is to improve powder metal bodies such as electric contacts, current carrying bearings or bushings, valve seats and the like.

Other objects of the invention will be apparent from the description and claims.

The present invention contemplates a metal composition made from iron group metal powders, particularly nickel and cobalt, which are individually coated with protective layers of a palladium-platinum group metal such as platinum, palladium or rhodium and are interspersed with and bonded to metal from the first group of the periodic table such as copper, silver or gold.

The nickel and cobalt powders may vary in average diameter between 50 and 400 mesh prior to coating and the coating of protective metal such as platinum, palladium or rhodium may vary in thickness from a fraction of a micron to several microns. Thus the relative percentages of nickel or cobalt and protective metals in the coated powders used for producing the metal composition of the present invention may fall within the following range of proportions:

	Per cent
Nickel or cobalt	95 to 99.9
Palladium-platinum group metal	0.1 to 5

The coated powders are interspersed and bonded with the first group metal and the resulting compositions may fall within the following range:

	Per cent
Coated nickel or cobalt powders	5 to 99
Copper, silver or gold	Balance

For a more ductile material, it will generally be desirable to produce compositions containing:

	Per cent
Coated nickel or cobalt powders	5 to 50
Copper, silver or gold	Balance

For a harder material the coated iron group powders will predominate, for example:

	Per cent
Coated nickel or cobalt powders	50 to 99
Copper, silver or gold	Balance

Following are several examples of suitable metal compositions:

	A	B	C	D	E
Nickel or cobalt coated with rhodium	50	60	15	30	40
Silver	50	40	85	70	60

	F	G	H	I	J
Nickel or cobalt coated with platinum or palladium	20	60	15	30	90
Silver	80	40	85	70	10

	K	L	M	N	O
Nickel or cobalt coated with platinum or palladium	25	75	60	95	40
Gold	75	25	40	5	60

The protective coating of rhodium, platinum or palladium may be applied by any one of several methods such as electroplating, cathode sputtering, metal spraying, condensing evaporated metal on the particle surfaces, chemical deposition. They may also be coated by first coating the powders with a dispersible adhesive, then dusting the adhesive coated particles with the protective metals in powder form and subsequently heating the coated powders to disperse the adhesive and diffusing the protective metal onto the surface of the nickel or cobalt powders. It is also possible to use a metal paste as a coating medium.

The metal compositions of the present invention may be made from the coated particles in several ways. The coated nickel or cobalt particles, or a mixture or them, may be pressed to form a powder compact and the compact then sintered at a suitable temperature such as 1000° C. to form a sinter-bonded metal body. This body is then impregnated with silver, copper or gold, or an alloy of two or more of these, by placing the first group metal in contact with the sintered compact and heating the assembly in a reducing atmosphere to a temperature above the melting point of the lower melting metal so that it will flow into the pores of the sintered body and fill them.

The metal composition may also be produced by mixing the coated particles directly with powders of copper, silver or gold, or mixtures of these, pressing the mixed powders and then sintering the pressed mixture at a suitable temperature such as 900° C. to produce the finished composition. If desired, subsequent repressing or coining operations may be applied to further increase the density and improve the physical characteristics of the composition.

A third method of manufacture comprises a combination of the above two methods. According to this method, a portion of the copper, silver or gold in the form of a powder is mixed with the coated nickel or cobalt powders and the mixture pressed in a suitable die. The pressed body is then sintered at a temperature to cause bonding, such as 950° C. Additional amounts of copper, silver or gold are then placed in contact with the sintered body and the assembly heated to a temperature above the lower melting point metal to cause impregnation.

During the sintering operation, according to any of the above methods, the protective layers of platinum, palladium or rhodium on the nickel or cobalt particles diffuse into the nickel or cobalt to a greater or lesser extent, forming alloys at the surfaces of the particles. These alloys are considerably more noble in character as far as oxidation is concerned than the nickel or cobalt particles themselves. The degree of diffusion of the protective metal will depend upon the time and temperature of the sintering process. It is also contemplated that in some cases the coated powders may be pre-sintered in the loose state to accomplish diffusion before the powders are used in manufacturing the metal composition.

An advantage of the present composition and process resides in the affinity between the first group metals such as copper, silver and gold and the protective metals such as palladium, platinum and rhodium. Since the first group metals have a tendency to alloy with the protective layers they are readily drawn into any pores or spaces in the metal compact resulting in a denser and more nearly perfect and homogeneous metal structure.

In some cases additions of small proportions of other ingredients may be made to the compositions. For instance, from a fraction of a per cent to 10% of carbon or boron may be added to the mixture. The carbon is preferably in the form of graphite. Also from a fraction of 1% to 30% of such elements as iron, manganese, molybdenum, silicon and tungsten may be added.

One important use of the metal compositions of the present invention is in electric contacts. Electric contacts have heretofore been produced of compositions of nickel or cobalt with silver in various proportions. However, such compositions have developed relatively high contact resistances between the contacting surfaces and have exhibited a substantial temperature rise when subjected to continuous operation. The use of a protective metal coating from the palladium-platinum group on the nickel or cobalt particles reduces the contact resistance considerably and produces a contact much less subject to overheating.

By using contacts formed of the compositions described on at least one side of a contact pair, sticking and high contact resistance can be eliminated in most cases.

While specific embodiments of the invention have been described, it is intended to cover the invention broadly within the spirit and scope of the appended claims.

What is claimed is:

1. A metal composition formed of particles of metal selected from the group consisting of nickel and cobalt coated with metal selected from the group consisting of palladium, platinum and rhodium and metal selected from the group consisting of copper, silver and gold interspersed with and bonded to said coated particles.

2. An electric contact formed of a metal composition composed of particles of metal selected from the group consisting of nickel and cobalt coated with metal selected from the group consisting of palladium, platinum and rhodium and metal selected from the group consisting of copper, silver and gold interspersed with and bonded to said coated particles.

3. A metal composition formed of particles of a first metal selected from the group consisting of nickel and cobalt coated with a second metal selected from the group consisting of palladium, platinum and rhodium, said second metal amounting to 0.1 to 5% of the weight of the coated particles, and a third metal selected from the group consisting of copper, silver and gold interspersed with and bonded to said coated particles, said coated particles amounting to 5 to 99% of said metal composition.

4. An electric contact formed of a metal composition composed of particles of a first metal selected from the group consisting of nickel and cobalt coated with a second metal selected from the group consisting of palladium, platinum and rhodium, said second metal amounting to 0.1 to 5% of the weight of the coated particles, and a third metal selected from the group consisting of copper, silver and gold interspersed with and bonded to said coated particles, said coated particles amounting to 5 to 99% of said metal composition.

5. A ductile metal composition formed of particles of a first metal selected from the group consisting of nickel and cobalt coated with a second metal selected from the group consisting of palladium, platinum and rhodium, said second metal amounting to 0.1 to 5% of the weight of the coated particles, and a third metal selected from the group consisting of copper, silver and gold interspersed with and bonded to said coated particles, said coated particles amounting to 5 to 50% of said metal composition.

6. A relatively hard metal composition formed of particles of a first metal selected from the group consisting of nickel and cobalt coated with a second metal selected from the group consisting of palladium, platinum and rhodium, said second metal amounting to 0.1 to 5% of the weight of the coated particles, and a third metal selected from the group consisting of copper, silver and gold interspersed with and bonded to said coated particles, said coated particles amounting to 50 to 99% of said metal composition.

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