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SILVER LITHIUM ALLOY

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This invention relates to a silver alloy suitable for use in place of pure silver and for uses to which previously known silver alloys have been employed, of which may be mentioned particularly, uses of the alloys of the present invention in connection with silver solders, electrical contacts, silverware, jewelry and dental alloys.

This application is a continuation in part of our prior-filed co-pending application S. N. 258,186, filed February 24, 1939.

It is an object of the present invention to provide an alloy which has improved electrical properties such as electrical conductivity.

It is a further object of the present invention to provide an alloy which shows great fluidity in the molten state and lends itself to casting of very intricate shapes.

It is a still further object of the present invention to produce an alloy which has improved wetting characteristics when used as a silver solder.

Another object of the present invention is to produce a new alloy which has superior electrical characteristics when used as an electrical make-and-break contact such as low material transfer, low contact resistance and freedom from welding or sticking.

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 present invention contemplates the addition to silver of lithium and metal from the group consisting of cadmium and zinc. It is contemplated that alloys may be produced according to the invention, having the ingredients combined in the following range of proportions:

	Per cent
Lithium	.002 to 3
Metal selected from the group consisting of cadmium and zinc	1 to 30

Balance, substantially all silver.

We have also found that the addition of the following elements may improve the characteristics of the present alloys covered by the present invention:

	Per cent
Tin	Up to 11
Manganese	Up to 20
Nickel	Up to 10
Phosphorus	Up to 8
Silicon	Up to 2

It is also possible to substitute copper for a substantial part of the silver.

A number of preferred compositions are given below:

	Per cent
1. Cadmium	20
Lithium	.01
Silver	Balance
2. Zinc	15
Lithium	.01
Silver	Balance
3. Silver	50
Cadmium	18
Zinc	16.5
Copper	15.2
Lithium	.3
4. Silver	53
Zinc	16
Copper	30.75
Lithium	.25
5. Silver	60
Zinc	15
Copper	20
Nickel	4.75
Lithium	.25

In addition to the baser elements, materials from the palladium, platinum or gold group may also be present up to 10% each.

The alloys of the present invention are preferably prepared by melting the ingredients together in the correct proportions. The lithium is preferably added in the form of a silver-lithium master alloy, containing approximately 15% of lithium. This master alloy has a very low melting point which is in the neighborhood of 410° to 450° C. and therefore will go readily into solution when added to the silver-copper melt.

The effect of lithium is to completely deoxidize the silver melt and to free same from other impurities which are harmful. Part of the lithium will be eliminated together with these impurities and the remaining melt will be free from inclusions and oxides. The presence of lithium also prevents the further oxidization of the melt during the heating periods to which the melt may be

subjected and the material retains a very high fluidity during pouring, resulting in extremely clean castings.

We have found that cadmium-silver alloys or silver-zinc alloys e. g. containing a small percentage of lithium such as, for instance, .01% or less will lend themselves much more readily to rolling and wire drawing operations, resulting in a material which is entirely free from surface blemishes and oxide stringers. Furthermore if such silver wire is being spun or if silver wire produced in that manner is being headed, a surface finish can be obtained with alloys of the new invention that excels anything obtainable so far with alloys of the prior art. Very often in heading of silver alloys containing elements of the second group of the periodic system, the formation of edge cracks or splits is encountered, causing a great number of rejects. By the addition of lithium to these alloys in the proportions specified these difficulties can be eliminated or materially reduced.

If lithium is used in higher proportions such as .05 to 1% it was found that alloys of silver with elements of the cadmium-zinc group will show greatly improved electrical characteristics. Contact alloys of this type have very improved characteristics as far as material transfer and contact resistance are concerned. It was also of great interest to find that the material transfer for this composition was from the cathode to the anode. In most silver base alloys the material transfer is in the opposite direction, therefore it seems desirable to use the material of the present invention in combination with another silver alloy having opposite transfer characteristics.

We have carried out a large number of experiments with compositions containing zinc and cadmium, to which was added .25% lithium. After the material was rolled into sheet or drawn into wire, tests were made using these alloys for silver soldering purposes. It was found that most excellent results were produced by these new combinations. In order to cheapen the silver solders or to lower the melting point by the formation of ternary or quaternary eutectics, it was found that the addition of copper could be made to replace a substantial portion of the silver. It was also found that the addition of such elements, as particularly manganese, tin, phosphorus and silver would further improve the performance of the alloys containing .25% of lithium when used for silver soldering purposes. The alloys will flow very readily and will wet the metals to be joined readily and produce a joint of very high physical strength.

Since lithium decreases the melting point of silver very materially and since an eutectic is formed at 2.7% lithium, having a melting point of 610° C. care must be exercised when these materials are processed at elevated temperatures and if they contain higher percentages of lithium.

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 and scope of the appended claims.

What is claimed is:

1. An alloy containing .002 to 3% lithium, 1 to 30% of an element selected from the group consisting of cadmium and zinc and the balance substantially all silver.

2. An alloy composed of .05 to 1% lithium, 1 to 30% of an element selected from the group consisting of cadmium and zinc and the balance silver.

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