

## UNITED STATES PATENT OFFICE

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## COPPER POWDER

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The present invention relates to copper powders, particularly to powders which are intended for use in the manufacture of pressed shapes.

It has long been the desire of metal powder producers to place on the market an extremely stable powder. Producers of electrolytic powders have had difficulty in making a stable material due to the presence of water soluble salts that are left in traces on the metal surfaces, and, being hygroscopic in nature, absorb moisture from the surrounding atmosphere. Experience has shown that the presence of moisture decreases the stability of metal powders.

In the production of metal powders by the reduction process, the problem of stability depends to some extent upon the source of metal oxides employed. If metal oxides that are to be reduced were obtained from a wet process where metal salts or acids were employed, traces of these salts appear in the final metal powder. The stability of such reduced metal powders, although somewhat better than the electrolytic, is not entirely satisfactory.

In all cases where the metal powder is held for a long time in a container that permits air to come in contact with the powder, extremely good stability is imperative. It is also important that powders which are to be mixed with other powders, and then pressed and sintered, blend and alloy readily.

It is accordingly an object of the present invention to produce a copper powder which has improved stability.

Another object of the invention is to provide a copper powder which will blend and alloy readily.

A further object of the invention is to provide a process for producing a copper powder having the foregoing properties.

It has been discovered that between about 0.05% and 0.3% metallic tin distributed in the form of thin films upon the surfaces of the copper particles produces a remarkable improvement in the stability of the copper powder. This is rather remarkable in view of the fact that the coating does not form a continuous film, or, if continuous, is of a microscopic nature, since the treated powder appears as bright as the pure copper powder.

It has been found that where the amount of tin is less than about 0.05% the improved stability is not obtained, since amounts less than this are insufficient to smear the surfaces of the copper powder with a sufficient film of tin to produce the desired results. Amounts more than

0.3% should not be used, since experience has shown that when tin is present in amounts greater than this, difficulty in compressing the metal powder is the result. It seems that higher than 0.3% tin tends to produce a higher copper-tin compound on the surface, causing hard compounds to be produced which may score the dies during the pressing of the metal powders, and which require high pressures for compressing to a desired density.

It was also surprising to note that the presence of this small amount of tin on the surface of the metal powder gave a copper powder product that blended better with tin powders. This is attributed to the degree of difference in electrostatic charges between the copper powder carrying the slightly tinned surface and the tin powder.

Also in the sintering operation where copper and tin blends are employed, microscopic examination indicates that the copper powder carrying a small percentage of pre-alloyed tin surface reacts with the tin powder to form a stronger bond than pure copper powder. It is believed that the partially tin coated copper powder gives a better alloying surface when alloyed with the tin powder in the compressed specimens that are sintered.

The powders of the present invention may be produced by incorporating between 0.05% and 0.3% tin either as metallic tin, tin oxide, or other reducible tin compounds with copper oxide and then reducing the copper oxide to the metallic state. Methods of carrying out the reduction of the copper oxide are well known, and per se form no part of the present invention.

Other methods which may be employed are to heat copper powder to which has been added the requisite amount of tin or tin compounds preferably with agitation until and under such conditions the tin is distributed in form of thin films on the copper powder. When reducible tin compounds are used the heating should be under reducing conditions. Reducing or at least non-oxidizing conditions should preferably be employed when using metallic tin and copper to prevent oxidation. Tendency to sintering may be retarded by employing a small amount of hydrocarbon according to U. S. Patent No. 2,173,100.

It is preferred to remove the extreme fines having a particle size less than 5 microns in diameter from the copper powder, as these fines induce uneven alloying and increase the pressure

required for compressing the powder to a desired density.

We claim:

1. A copper powder for use in the manufacture of pressed shapes containing from about 0.05% to 0.3% metallic tin distributed in the form of fine films upon the surface of the copper particles.

2. A copper powder for use in the manufacture of pressed shapes containing between 0.05% and 0.3% of tin distributed in the form of thin films alloyed on the surface of the particles of copper powder.

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