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PROCESS OF PRODUCING METAL POWDERS

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1 Claim. (Cl. 18—47.2)

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This invention relates to metal powders. It relates particularly to methods for preparing metal powders and metal dispersions.

In accordance with this invention, a molten, relatively nonvolatile, metal is mixed with another molten, relatively volatile, metal having a limited miscibility therewith, which miscibility increases with temperature. This mixture, so proportioned that it will be completely miscible at a given temperature, is heated to that temperature under pressure. The pressure is then suddenly released and the mixture allowed to spray into an evacuated chamber. As a result, the volatile metal will separate from the nonvolatile metal in tiny droplets which will immediately become vapor and disintegrate the nonvolatile metal into fine particles which, on solidifying in the vapor of the volatile metal, will become coated therewith. Such coated particles may be compacted to form metal dispersions or the coating may be removed mechanically or chemically and the powdered nonvolatile metal used for any purpose.

As an example, aluminum may be selected as the nonvolatile metal and potassium as the volatile metal. At a temperature of 1500° F., about 1% of potassium dissolves in aluminum under a pressure of 10 atmospheres. If such a mixture is sprayed into a vacuum, a fine powder of aluminum coated with potassium is obtained. The potassium can be removed by washing with water. If cesium is substituted for potassium, the resulting powder may be compacted to form a cesium-aluminum dispersion which is ideally suited for the purpose of preparing improved electrical conductors in accordance with my co-pending application Serial No. 700,385, filed October 1, 1946, now abandoned, in which it is disclosed that dispersions of cesium with certain other metals possess improved electrical conductivity.

Examples are listed in the following table:

Nonvolatile Metal	Volatile Metal
Aluminum, M. P. 1214° F.	Cesium, B. P. 1238° F. Sodium, B. P. 1638° F. Potassium, B. P. 1425° F. Rubidium, B. P. 1292° F.
Copper, M. P. 1981 Manganese, M. P. 2268	Magnesium, B. P. 2025° F. Lithium, B. P. 2502° F.

The temperature of operation must be selected above the melting point of the nonvolatile metal and above, but not too far above, the boiling point of the volatile metal. Temperatures of more than

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50° F. and less than 500° F. above the boiling points of the volatile metal have been found satisfactory. In a specific example, aluminum is mixed with cesium and held under pressure at 1288° F.–1500° F. and then sprayed into an area of lower pressure. The particles of aluminum coated with cesium which are formed in this way are compacted to produce a metal article.

The removal of the volatile metal coating from the particles of nonvolatile metal may be accomplished by reaction with water or dilute acid. In the case of the alkali metal, alcohol may be used to reduce attack on the metal powder, for example, aluminum. The volatile metal coating can also be removed by mechanical tumbling, for example, with sand or other inert material of such sieve size that the metal powder can be separated easily from the polishing particles.

What is claimed is:

The process of producing dispersions of aluminum and an alkali metal which includes the steps of mixing the aluminum at a temperature slightly above its melting point with about 1% of at least one metal selected from the class consisting of cesium, sodium, potassium, and rubidium heating the mixture in a closed space to a temperature of 1288° F. to 2138° F. to bring about complete miscibility of the aluminum and the alkali metal and a pressure of the alkali metal vapor of 1–10 atmospheres and then opening said closed space to a space having an inert atmosphere at a lower pressure whereby to spray the liquid into said space.

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