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HEAT TREATMENT OF METALS

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This invention relates to the heat treatment of metals and more particularly to the use of fused salt baths as heating means.

Heretofore the heat treatment of various metals such as iron, steel and non-ferrous metals, including copper, aluminum, nickel and their alloys, has often been carried out by immersing the metals in baths of various fused materials. The fused baths commonly used for this purpose are molten lead or fused salts. Various fused salt mixtures have been used, depending upon the desired temperature of the heat treatment. When it is desired to carry out heat treatments at relatively low temperatures, salt baths which are commonly used for this purpose consist of the alkali metal nitrates and nitrites or mixtures of these. When using the nitrates and nitrites it is possible to heat treat at temperatures ranging from 460 to 600° C. but these baths are not suitable for heat treating at any range much outside of these temperatures. The melting points of these baths are not sufficiently low to permit efficient operation much below 460° C. Also at temperatures around 530 to 550° C. or higher, nitrate or nitrite baths tend to decompose and at higher temperatures such decomposition is likely to become violent. Baths of fused metal have been used to some extent for low temperature operation but fused metal baths, for example, fused lead, are disadvantageous in that the cost of the metal is relatively high and due to the great weight of the molten metal, a rather expensive installation is required. Furthermore, when lead or a lead alloy is used, there is a certain hazard of lead poisoning among the operators. It is therefore usually preferable to use fused salt baths for low temperature heat treatment.

The object of the present invention is to provide an improved fused salt heat treating bath which is well suited for relatively low temperature heat treatment and yet also may be used for heat treating metals at high temperatures without undergoing substantial decomposition. A further object is to provide an improvement in methods of heat treating metals. Other objects will be apparent from the following description of our invention.

The above objects are obtained in accordance with the herein described invention by providing a fused salt bath containing a mixture of two or more alkaline earth metal chlorides, to which mixture is added one or more alkaline metal chlorides, said bath containing not more than about 10% by weight of potassium chloride or other potassium salt. Preferably, we employ a fused mixture containing little or no fusible potassium salt.

By means of our novel combination of salts we are able to make up a fused salt bath having a melting point of 430° C. or even lower. A bath having a melting point of about 430° C. may be made for example, by fusing together a mixture of 48% by weight of calcium chloride, 31% of barium chloride and 21% of sodium chloride. We have made the surprising discovery that while such low melting points may be obtained by mixing alkali metal chlorides such as sodium chloride or potassium chloride with mixtures of alkaline earth metal chlorides, the presence of potassium salts such as potassium chloride, even in relatively small amounts, causes a marked rise in the melting point of the mixture. For example, if in the above described mixture having a melting point of 430° C., about one-half of the sodium chloride is replaced by potassium chloride, the melting point of the resulting mixture will be 580° C. Further by adding only about 7% of potassium chloride to the above described mixture, the melting point will be raised from 430 to about 442° C. We therefore prefer to make up our fused salt baths substantially free from potassium salts. However, potassium salts in amounts up to about 10% by weight may be added without greatly raising the melting point, as shown by the above illustration.

The proportion of the alkaline earth metal chlorides in the fused mixture may be varied over a wide range in practicing the present invention. While various mixtures of the alkaline-earth metal chlorides may be used, we prefer to use mixtures containing at least about 5% of each such chloride. Also we prefer to use such mixtures which contain calcium chloride and barium chloride. To such mixtures we may add an alkali metal chloride such as sodium chloride or lithium chloride, preferably adding that amount which is found to produce the maximum decrease in the melting point. It is often desirable to add more than one alkali metal chloride to the fused mixture. For example, the addition of about 5% of lithium chloride to the above described mixture of barium chloride, calcium chloride and sodium chloride lowers the melting point from 430° C. to about 406° C.

Fused heat treating baths according to the present invention are substantially chemically inert and can be heated to high temperatures with substantially no decomposition. Such baths therefore are suitable not only for low tempera-

ture heat treatment but also are well adapted to heat treatment at high temperatures, e. g. as high as 800 to 900° C. They have no deleterious effect upon the heat treating vessel nor the metals which may be heat treated therein and they present no hazard of poisoning to the operators.

We claim:

1. A fused salt mixture for heat treating metals which is composed of approximately 45% of calcium chloride, 30% of barium chloride, 20% of sodium chloride and 5% of lithium chloride, the melting point of said mixture being about 406° C.

2. A process for heat treating metals comprising immersing metal articles in a fused salt mixture at a temperature between about the melting point of said mixture and 900° C., said mixture having a melting point of about 406° C. and being composed of approximately 45% of calcium chloride, 30% of barium chloride, 20% of sodium chloride and 5% of lithium chloride.

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