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PROCESS FOR THE PRODUCTION OF METAL ALLOYS

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2 Claims. (Cl. 75-122)

Our invention relates to the production of alloys from metals with great affinity to gases such as oxygen or nitrogen, for instance, beryllium, titanium, zirconium, thorium or tungsten with other metals.

To alloy these metals with other metals such as copper, iron, nickel, molybdenum or their alloys, especially steels made therefrom is extremely difficult. During the addition of these highly oxydizable metals to a copper melt for the production of an alloy, the reactive metals oxidize so quickly that only a relatively small percentage alloys with the copper. The loss by burning of the valuable reactive metal is rather heavy. Moreover, the oxides of these metals cannot or can only partly be separated from the melt, thereby tending to decrease the mechanical properties and the workability of the alloys. Finally, it is thereby nearly impossible to control the ratio of the amounts of the alloy components.

It was therefore suggested to carry out the melting process either in vacuo or in a protecting gas atmosphere whereby, however, considerable technical and apparatus difficulties occurred which made the production of these alloys nearly impossible.

According to our invention we have found that metal alloys from metals with great affinity to gases—such as oxygen or nitrogen—as, for instance, beryllium, titanium, zirconium, thorium, tungsten with other metals, for instance, copper, iron, nickel, molybdenum or their alloys may be produced in such manner that in the first step the metals are diffused together at temperatures below their fusion points, if desired under pressure, thereby producing a preliminary alloy and finally alloying these alloys with less reactive metals. Surprisingly, these reactive metals rather lose their affinity to, for instance, oxygen, so that they may be remelted without any danger to be oxidized.

In carrying out our invention we proceed in such manner that the reactive metals are embedded in less reactive metals or their alloys. Thus, for instance, a finely divided strongly oxidizable metal is filled into a copper tube, closed on one end, sealed with a copper layer and heated to temperatures below the fusion point of both metals. It is advantageous to choose the temperature in such manner that it lies only slightly above the eutecticum which may be formed of the two alloy components or, in case of absolute solubility in a solid state, just above the solidus line. Hereby the metals diffuse with each other.

The diffusion may be enhanced by utilization of a light pressure, for instance, hydraulic pressure.

Another way of carrying out our invention, especially for the production of alloys with a higher content of reactive metals, consists in an alternate filling of a form of less reactive metal, for instance, a copper tube with the susceptible and non-susceptible metal in form of briquets, for instance, lamellae of zirconium and copper layers. This copper ingot is now heated, for instance, for one hour at a temperature far below the fusion point of the metals, i. e. at about 940-970° C. and that in contact with the open air. The pressure is hereby preferably chosen in such manner that already below the working temperature the copper tube is subjected to a certain deformation which causes an airtight occlusion of the metal lying therein and an intimate contact of it with the copper. This intimate contact accelerates the diffusion at the working temperature.

The so formed preliminary alloys may be melted in the open air before the production of the final alloys without any loss by burning, thereby causing an absolutely homogeneous structure. They may also be directly alloyed with the less reactive metals, as usual.

Our invention shows several advantages. It enables the production of alloys of metals reactive to oxygen, nitrogen or the like without the utilization of vacuum or a protecting gas. Nevertheless, a loss by burning with the formation of oxides and contamination of the formed alloys is absolutely prevented. Furthermore, by the production of a preliminary alloy in a solid state the danger of liquation or segregation in the remelting process of the preliminary alloy or in the melting operation of the final alloy will be considerably lessened. This is of extraordinary importance with alloys resulting from components with very different density. Finally, it is possible according to our invention, to produce final alloys with definite composition through the formation of a preliminary alloy.

What we claim is:

1. A process for the production of a metal alloy from at least one reactive metal having a great affinity to gases selected from the group consisting of beryllium, titanium, zirconium, thorium and tungsten and at least one less reactive metal selected from the group consisting of copper, iron, molybdenum and nickel, which comprises mixing the reactive metal in finely divided form with the less reactive metal, inclosing such mixture in a casing of the less reactive metal and heating

the combination to a temperature below the melting point of the respective metals to cause diffusion of the metals to form a preliminary alloy and employing this alloy to introduce the desired quantity of the reactive metal in further quantities of the less reactive metal.

2. A process for the production of a metal alloy from at least one reactive metal having a great affinity to gases selected from the group consisting of beryllium, titanium, zirconium, thorium and tungsten and at least one less reactive metal

selected from the group consisting of copper, iron, molybdenum and nickel, which comprises forming briquets of the reactive and the less reactive metals, introducing such briquets alternately into a casing of a less reactive metal, heating the filled casing to temperatures below the melting points of the metals to cause diffusion of the metals to form a preliminary alloy.

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