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HIGH TEMPERATURE ALLOY

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The present invention relates to cast molybdenum-base alloys. The object of the invention is to provide a molybdenum-base alloy casting capable of being worked at elevated temperatures and having high strength at temperatures above 1600° F.

As set forth in United States Patent 2,678,269, it has been known that highly advantageous properties are obtained with molybdenum castings containing from .25% to 14% titanium and from .01% to .25% carbon. However, it has previously been thought that quantities of carbon in excess of .07% increase the difficulty of working the alloy without producing any compensated advantage. In accordance with the present invention, it is now found that if the titanium content of molybdenum-base castings is increased above the lower portion of the range set forth in United States Patent 2,678,269, decided advantages flow from the employment of a carbon content in the range of .30% to .75%.

The alloys of the present invention contain from 1.00% to 8.00% titanium and from .30% to .75% carbon. Such alloys in the form of castings may be worked at elevated temperatures in the range of 2300° F. to 3000° F., provided the oxygen content does not exceed .005%. The preferred alloys contain less than .002% oxygen.

The benefits of the present invention are also realized if small quantities of zirconium are present. Accordingly, it may be included as an optional constituent in amounts up to but not more than about .50%. In addition a portion of the molybdenum may be replaced by tungsten up to a maximum tungsten content equalling the molybdenum content. In all cases the balance of the alloy is molybdenum or molybdenum and tungsten.

The alloy of the present invention may be prepared by arc-melting in vacuum, preferably using a furnace of the type disclosed in United States Patent 2,656,743. Carbon is added to react with any oxygen present in raw materials and in a quantity which will leave the desired excess in the final casting. The best results are obtained when the residual carbon content increases proportionately within the above stated range as the titanium content increases within the range stated. The absolute

pressure during the melting operation is preferably maintained below 50 microns of mercury.

The raw material used in making the new alloy consists of molybdenum powder having an oxygen content ranging from .012% to .029% and titanium sponge having an oxygen content below .20%.

A specific example of a new alloy in accordance with the present invention is an alloy containing .50% carbon, 3.20% titanium and not more than .002% oxygen. This alloy is found to have a tensile strength in a fully recrystallized condition at a temperature of 1800° F. of 51,000 pounds per square inch, which makes the alloy one of the strongest known materials at that temperature in a fully recrystallized condition. Other examples of the invention include an alloy containing .38% carbon and 1.17% titanium, an alloy containing .75% carbon and 4.63% titanium, and an alloy containing .75% carbon and 8.00% titanium. Each of the above mentioned examples contain molybdenum as the balance of the composition.

An example of an alloy which also includes zirconium is one containing 1.27% titanium, .29% zirconium, and .30% carbon, the balance consisting essentially of molybdenum.

In any of the foregoing examples a portion of the molybdenum may be replaced by tungsten so long as the tungsten content does not exceed the molybdenum content.

All proportions given are proportions by weight.

What is claimed is:

1. A cast molybdenum-base alloy capable of being worked at elevated temperatures and containing from .30% to .75% carbon, from 1.00% to 8.00% titanium, not more than .005% oxygen, and the balance consisting essentially of molybdenum.

2. A cast molybdenum-base alloy capable of being worked at elevated temperatures and containing .50% carbon, 3.20% titanium, and the balance consisting essentially of molybdenum.

3. A cast molybdenum-base alloy capable of being worked at elevated temperatures and containing from .30% to .75% carbon, from 1.00% to 8.00% titanium, not more than .005% oxygen, not more than about .50% zirconium, and the balance consisting essentially of metal from the group consisting of molybdenum and tungsten with the molybdenum content being at least equal to the tungsten content.

References Cited in the file of this patent

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2,780,545	Blank et al.	Feb. 5, 1957

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