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## HARD CARBIDE COMPOSITION

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In the making of tool bits, forming dies, drawing dies, and the like, hard carbides are extensively used, especially the carbides of tungsten and tantalum. These carbides are extremely difficult to melt, and when solidified from the melted state they are porous, coarsely crystalline, and lack strength. For these reasons they are usually fabricated by mixing the powdered carbide with a powdered metal of comparatively low melting point, such as cobalt, nickel, or iron, and then pressing into the required shape and heating until the metal fuses and cements the carbide particles together. The shapes that can be produced by this process are somewhat limited and the process is not at all as simple as a casting process.

Attempts have also been made to cast mixtures of carbide with cementing metal, such as cobalt, nickel or iron, but unless the carbide content is made prohibitively small the casting temperature of the mixture is so high (well above 2500° C.) as to render the process commercially impracticable. Furthermore the great difference in specific gravity between cobalt and the tungsten carbide, which usually are employed, is so great that segregation and lack of uniformity occur in the resulting composition.

An object of the present invention is to overcome the foregoing difficulties by providing a carbide composition that has a melting point within practicable limits.

Another object of the invention is to provide a carbide composition which is strong, dense, and hard, in the cast condition.

Still another object of the invention is to provide a carbide composition which can be fabricated directly into useful shapes by a process of casting.

The metallic carbides as a class are among the most refractory of materials and therefore cannot be conveniently melted for casting. This is especially true of the very hard carbides used in the manufacture of metal cutting tools. While metals may be combined to form alloys which have melting points lower than their constituents, this is not generally true of carbides. Thus, according to the scientific literature, mixtures of tantalum carbide with zirconium carbide or hafnium carbide both melt above the melting point of either constituent. I have discovered however, that a mixture of approximately equal parts by weight of vanadium carbide and molybdenum carbide melts well below the melting point of either constituent. This mixture is thoroughly liquid at a temperature of about 2475° C. while its constituents melt at considerably higher points, vanadium carbide at 2750° C., and molybdenum carbide at 2960° C.

Besides providing a very liquid melt at a temperature that is comparatively low for carbides, this mixture has other properties desirable in a substance of this kind. The cast material is solid, dense, and strong, and shows no segregation. Its hardness, as nearly as can be determined is at least equal to, and probably greater than that of tungsten carbide. It produces castings having a sharp definition of outline. It can be cast in the pure state, or if desired additions of cobalt or the metals of the iron group can be made. If such additions are made there is no segregation, as with tungsten carbide, apparently because the specific gravities of the carbides and the added metal are very nearly equal.

In the practice of this process the two carbides are prepared in finely powdered form. The required vanadium carbide has a carbon content of about 18% while the molybdenum carbide contains about 6% of carbon. The two powders are thoroughly blended in a ball mill, and then sifted through bolting cloth. To facilitate handling, the sifted powder can then be pressed into briquettes of any convenient shape. The pressed briquettes are then placed in a crucible of carbon or graphite and heated in a furnace having a reducing atmosphere. An electrical resistance furnace having a tubular carbon or graphite resistor serves quite well, and a reducing atmosphere can be maintained by the passage of either carbon monoxide or hydrogen, preferably the latter, through the furnace. If a binding metal is desired it can be added to the melt. Castings can be made in carbon or graphite molds.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A cast alloy consisting chiefly of molybdenum carbide and vanadium carbide, said carbides being present in said alloy in substantially equal parts by weight, the remainder of said alloy consisting of metal of the iron group.

2. A cast alloy consisting of substantially equal parts by weight of molybdenum carbide and vanadium carbide.

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