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INVESTMENT COMPOSITION

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This invention relates to investment compositions for the making of refractory molds for use in casting metals, alloys and other suitable casting materials. The composition is particularly intended for use in molds for casting dental inlays, dentures and the like, although the composition is equally adaptable for use in molds for casting articles of jewelry and other objects.

Known investment compositions of this general character generally comprise a ground siliceous refractory base such as silica in its various forms, and a binder such as a gypsum product, for example plaster of Paris. Other ingredients or agents for the purpose of accelerating or retarding hardening, setting or expansion of the composition, or to modify the plasticity of the composition to facilitate mixing and shaping thereof, are also frequently included in such investment compositions.

The customary procedure in making molds of such compositions and casting articles therein, consists in shaping a preliminary wax model or pattern of the object to be cast, for example a dental inlay, mixing the investment composition with a suitable liquid, for example, water, constructing the mold around the pattern, allowing the mold to set, heating the set mold preferably to the casting temperature which is sufficient to melt out or evaporate the wax model and expel gases and water present in the mold so as to leave a cavity corresponding in shape and size to the model, then pouring the molten casting material, for example gold, into the heated mold cavity and allowing the casting to cool.

Generally the molds are heated to a temperature of from 900° F. to 1500° F. before the casting is formed, which causes the mold to expand, and the casting material after having been put in the mold cavity usually shrinks during cooling. Therefore, in order to obtain a casting which shall conform exactly in size and shape to the model, the expansion of the mold must correspond as exactly as possible to the shrinkage of the casting material. Generally this expansion is slightly above 1%, for example in the case of gold casting, about 1.25%.

Also, it is desirable that the casting shall have a smooth surface free from cracks, pin holes and pits, and accordingly the investment composition must be such that it will freely and accurately conform to the surface of the wax model and without formation of air bubbles between the model and the mold, shall also permit easy and complete driving off of moisture and gaseous substances prior to the casting operation, and shall not crack during heating or cooling.

Heretofore it has been proposed to include in investment compositions certain metals or metal oxides as well as minerals and other compounds for the purpose of obtaining the desired expansion characteristics, surface of the mold cavity, etc. However, many of such substances or compounds while ensuring or improving one or the other desired characteristics such as proper expansion, setting, plasticity for molding, etc., also have the serious disadvantage that they deleteriously affect other required properties of the investment material and the mold; for example, while suitable expansion may be obtained, the surface of the mold cavity may be unsatisfactory, or vice versa and so on.

Therefore, prime objects of the invention are to provide a novel and improved investment composition which shall have all of the desired characteristics and advantages and shall eliminate or obviate the objections to or disadvantages of known investment compositions, and particularly to provide such a composition which shall have the required expansion characteristics and at the same time shall insure smoothness and exactness in detail of the casting formed in a mold consisting of the investment composition.

Other objects are to provide such a novel and improved investment composition which can be caused to accurately conform to a model or pattern without difficulty and without danger of trapping of air between the model and the mold such as might cause pits or inaccuracies in detail in the casting; and to obtain other advantages and results as will be brought out by the following description.

In making my investment composition, I add to the known ingredients and constituents of such compositions, titanium compounds, for example titanium oxides, and more particularly titanium dioxide. The titanium compounds may be added to the regular commercial or known compounds as they are supplied by the manufacturers and before use of the compounds, but preferably I mix the titanium compounds with the other ingredients during manufacture of the composition so that the titanium compounds comprise a part of the manufacturing formula.

As a specific example, in making my composition I may use a suitable siliceous filler, such as ground silica, a binder of ground gypsum, and titanium compound, preferably titanium oxide. Also, I may add other materials such as boric acid,

retarder, or accelerator, and if desired a suitable coloring matter may be included. The proportions of the various ingredients may be varied and the percentage of titanium compounds may vary from 0.1% to about 15% by weight. I have discovered that the presence of even very small and minute amounts of titanium compounds will give noticeable beneficial effects. The preferred range of percentages of titanium compounds lies between 0.5% and 5%, although I have found that 2% is most satisfactory with the proportions of other ingredients now used by me.

The proportion of silica may for example be from 60 to 80%, while the gypsum may constitute for example from 20 to 40%, and preferably ground silica comprising different sizes of particles, is used.

The titanium compound may be mixed with the other ingredients in any suitable manner, and for forming a mold the mixture is reduced to plastic condition by a suitable neutral, alkaline or acid liquid, preferably water.

I have found that the titanium compounds, especially titanium dioxide, reduce the surface tension of the plastic mixture so that the mixture may be caused to freely flow over the wax model with a minimum of tendency to "ball" or form globules or pull away from the model, whereby the possibility of trapping air between the composition and the model is reduced to the minimum. Accordingly the plastic mixture may accurately conform to the model even at sharp angles and the mold cavity surface will be smooth and free from cracks, pin holes or pits. At the same time, a mold formed of my composition has the required expansion characteristics which may be controlled up to 1.6% by varying the temperature during heating. Therefore the investment composition of the invention enables the formation of molds for and casting of articles exactly corresponding in shape, size and surface finish to the wax model.

While I have described the use of titanium compounds in a particular type of refractory mold composition, it should be understood that the use of titanium compounds in other types of refractory mold composition is within the spirit and scope of the invention. Also, instead of gypsum as a binder, I may use other suitable binders, for example Portland cement.

Having thus described my invention, what I claim is:

1. An investment composition comprising a major portion of a siliceous filler and gypsum, and a relatively small proportion of a titanium compound.

2. An investment composition comprising a major portion of a siliceous filler and gypsum, and a relatively small proportion of titanium dioxide.

3. An investment composition comprising a major portion of a siliceous filler and gypsum, and from 0.1 percent to 15 percent of titanium compound.

4. An investment composition comprising a major portion of a siliceous filler and gypsum, and from 0.1 percent to 15 percent of titanium dioxide.

5. An investment composition comprising a major portion of a siliceous filler and gypsum, and about 2 percent of titanium compound.

6. An investment composition comprising a major portion of a siliceous filler and gypsum, and about 2 percent of titanium dioxide.

7. An investment composition comprising a major portion of a siliceous filler and gypsum, and from 0.5 percent to 5 percent of titanium dioxide.

8. A composition of matter comprising ground silica, ground gypsum, and titanium dioxide.

9. A composition of matter to be shaped in plastic state around a model for making a refractory mold, said composition comprising a refractory filler, and a refractory binder, and having its surface tension in plastic state reduced by the addition of titanium compound.

10. A composition of matter to be shaped in plastic state around a model for making a refractory mold, said composition comprising a refractory filler, and a refractory binder, and having its surface tension in plastic state reduced by the addition of titanium dioxide.

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