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SYNTHETIC GEM COMPOSITION AND METHOD

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This invention relates to hard, smooth surfaced synthetic gem compositions whose surfaces are capable of taking a high polish, and the method of making such compositions. More particularly it relates to such compositions in which copper oxide and titanium oxide are combined with at least two other color oxides to provide colored compositions such as a black or silver black composition.

A large variety of rocks and minerals usable for various purposes has its value enhanced by the relative rarity of the materials. The factor of chance in the locating of whatever supplies of such materials exist and the fact that where such supplies are located they are not normally extensive, tend to add to the value of the materials. Other factors affecting the appeal of such materials are their durability, their chemical resistance, their light reflective properties, their pleasing color, susceptibility to easy working, their variations in design and structure, and their capability of taking a high polish on the surface thereof. In the commercialization of these rocks or minerals any one or any combination of the above factors may be determinative of their usefulness. Some factors enhance their value as pieces of jewelry, others are more important in capacities such as bearings for delicate instruments, thread guides or phonograph needles, while luxury uses such as for cigarette boxes, statuary and clothing accessories may take advantage of other characteristics.

Examples of materials of the type just referred to are hematite, obsidian, onyx or sphalerite. These are commonly used in the preparation of steel gray, black and walnut brown settings for men's rings, in the preparation of cameo and intaglio designs. These materials are used not only because they are susceptible of taking a high polish but also because though quite hard they are not too hard to preclude the cutting of a design into them. Vari-colored onyx is another one of the materials used as indicated. It is often employed as an expensive furniture accessory.

The disadvantages attendant on the use of the materials above referred to are quite numerous. As already pointed out, the supply is uncertain and even then, considerable variation in that supply is the usual thing. Furthermore it is necessary to cut any design that may be desired into the material which limits the designs that may be employed and, in some cases, involves considerable expense. This expense is attendant upon any workings of such materials for it is work that must be performed by highly skilled artisans and different artisans are needed for each class of materials and often for each type of operation to be performed on those materials.

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The compositions of this invention are fitting, though economical, replacements for the stones and minerals described above. My compositions possess characteristics of hardness, strength, durability and density comparable to those of the stones and minerals referred to. Nevertheless, they can, if required for jewelry pieces, be formed with intricate though accurate designs of considerable variety, and the manner of forming is such that the only finishing operation that is needed is the polishing of the surface. Furthermore, by following the method of my invention, these compositions can be formed with considerable speed and in substantial volume so that a highly economical product results. The color and physical characteristics of this product can also be controlled and duplicated. The product is tougher and more dense than the usual semi-precious stones and is as hard or harder than the run of such stones. Finally, material which is uniformly jet black or silver black can be produced in accordance with the method of my invention and can be duplicated with uniformity. These are among the most difficult colors to produce or duplicate.

It is therefore an object of the invention to provide compositions which will serve as suitable replacements for semi-precious stone materials heretofore employed found in nature.

It is another object of the invention to provide a method for forming such compositions.

Another object of the invention is to provide compositions being uniformly colored in the color desired and having hard surfaces capable of taking a high polish.

Still other objects of the invention concern compositions and process of making the same in which the finished form may present suitable designs without the necessity of expensive cutting operations.

Further objects of the invention concern the provision of compositions of high quality which are nevertheless economical to produce and can be reproduced with uniformity.

These and still further objects of the invention will be apparent from the ensuing disclosure of the preferred embodiment thereof and method of forming the same.

As an example of the generally preferred and more simple composition of my invention, the

same consists of at least 5% copper oxide, at least 5% titanium oxide with the balance, or major part, of the mix consisting of two or more of the oxides taken from the group iron oxide, cobalt oxide, nickel oxide and chromium oxide. Such a composition provides for the resultant product to be of maximum density. In cases, however, where maximum density is not required, it is more economical to flux the base oxides with one or more of the silicates taken from the group calcium silicate, calcium magnesium silicate, the mineral known as nepheline syenite, which is a sodium aluminum silicate, or feldspar, preferably a potash feldspar. Though these fluxes of course reduce the density, they may nevertheless be used to the extent of 50% of the total composition without affecting the deep black color which can be obtained without them.

In order to develop the description of the method of my invention, let us assume that the composition to be worked with consists of 100 parts of titanium oxide, 100 parts of copper oxide, 800 parts of iron oxide and 800 parts of cobalt oxide. This material must first be prepared and then be fired. As part of the preparation I carefully select the oxides to be used and preferably employ those which have been chemically prepared. As an example of this, the iron oxide which I prefer to use is that which is normally employed as a pigment and is produced by the calcination of copperas or other sulphate compound.

As the initial step in the preparation, once the properly selected materials in proper quantities have been assembled, I mix them in a suitable mixing device such as a blender, and pass them through a disintegrating machine in order to separate the agglomerates. This preliminary preparation having been completed, the first real stage of preparation is now in order. This stage involves the calcination of the batch at a bright red heat, continuing for a sufficient length of time to assure that every portion of the batch has been subjected to the full heat for at least an hour. This calcination of the batch is a requisite for the provision of a final article which will take a suitable polish.

After the completion of the calcination, the batch is ground in a pebble mill in wet slip form up to a fineness that will pass a 400 mesh screen. As an additiontal step to assure its fineness and uniformity, the batch is passed through a silk bolting cloth in order to eliminate any coarse particles. The remaining product is dried to powder form. The dried powder is disintegrated and is then ready to be mixed with pressing aids so that it may be given the proper formation for the final firing and finishing steps. The batch and treatment of the same just discussed are, as previously pointed out, the pure mixture which I employ when economy is not a factor and where maximum density is required. If, however, a more economical mix is desired and density is not so important, I may employ a flux in an amount up to 50% of the total composition. These fluxes could, generally speaking, be at least one of the silica bearing type or, as already pointed out, could be calcium silicate, calcium magnesium silicate, nepheline syenite or a potash feldspar.

To flux the mixture just described or any mixture involving the desired number of the oxides, copper oxide, titanium oxide, iron oxide, nickel oxide, cobalt oxide and chromium oxide, they are calcined together, dried and disintegrated as just described. The finely powdered flux is then added to the calcined mixture of oxides, the body is blended and is ready to prepare for pressing into shape.

Assuming that the batch, whether including flux or not, has been prepared to the stage where it is a dried powder, I next prepare it for forming and firing. This calls for mixing the dried powder with pressing aids to hold portions of it in shape when they are formed ready to be fired. I use the pressing aids usual in the ceramic industry, such as wax emulsions, solutions of starch, dextrine and the like. Suitable portions of it are then formed into pre-selected shape or with pre-selected designs by pressing them in presses equipped with suitably shaped dies. The pieces thus shaped are then allowed to stand until they are dried.

The formed and dried pieces are fired to the maturation temperature which for this particular composition is 2,000° F. An absolute control to this temperature is not, however, necessary, for one fortunate advantage of this particular composition is that the firing temperature can run up to 2200° F. without destroying the desired properties of the material. Once the firing has been completed and the blank piece has cooled, its surface can then be finished and polished according to procedure well known to lapidaries.

As previously noted, the material of my invention will take a high polish whether it is of maximum density or is fluxed to a less dense mixture. In order to obtain such a polish, however, the preparation for firing must be carefully carried out and uniformly followed. This assures that the crystalline structure which develops in the course of the firing is such that the body is substantially at zero porosity and the grains can be sectioned without fracture. Thus no space can be allowed to develop between the particles in the crystallization process.

While the foregoing description deals specifically with one of the compositions of my invention, the constituents of the same and the method followed in forming the same, I have, as already pointed out, determined that a comparable product can be produced though the constituents and their proportions are varied somewhat. The following table shows examples of such variations:

Example	TiO_2	CuO	Fe_2O_3	CoO	NiO	Cr_2O_3
1	200	200	800	800		
2	100	100	800		800	
3	200	200	800		800	
4	100	100	1,200	400		
5	200	200	1,200	400		
6	100	100	700	800		100
7	200	200	700	800		100
8	100	100	800	400	400	
9	100	100	700	400	400	100
10	200	200	700	400	400	100
11	100	500		500		500
12	100	500		500	200	500

Any of the batches made in accordance with the above examples may be diluted with any one of the silica bearing fluxes, as pointed out above in considering the preferred composition. The modified compositions like the preferred one present a uniform solid color.

From the above, it will be readily apparent that I have devised not one but several compositions which meet the demand for high grade ornamental material. The supply of them is ample and is not open to the speculative aspect introduced when any relatively rare material must be discovered in the earth and then mined. Furthermore my composition may be worked much

more economically than mined stones, yet the product of my invention has all the strength, durability, toughness and hardness of such stones or materials. From the variety of constituents I have disclosed and the variety of proportions of the same, it is obvious that my disclosure is merely illustrative and that changes and modifications may be made in such embodiments without departing from the spirit or scope of my invention. Accordingly it is to be understood that the scope of my invention should be construed in accordance with the prior art and the appended claims and not by reference to the proportions and combinations which I have employed for purposes of illustration.

I claim:

1. A composition material comprising black copper oxide, white titanium oxide and at least two of the oxides taken from the group iron oxide, cobalt oxide, nickel oxide and chromium oxide, the sum of the copper oxide and titanium oxide being less than the remainder of the composition.

2. A composition material comprising minor proportions of black copper oxide and white titanium oxide, and major proportions of at least two of the oxides taken from the group iron oxide, cobalt oxide, nickel oxide and chromium oxide.

3. A composition material comprising minor proportions of black copper oxide and titanium oxide, and the remainder, being at least 75% of the total, being comprised of two of the oxides from the group iron oxide, cobalt oxide, nickel oxide and chromium oxide.

4. A composition material comprising at least 5% copper oxide, at least 5% titanium oxide, and the balance consisting of at least two of the oxides taken from the group iron oxide, cobalt oxide, nickel oxide and chromium oxide.

5. A composition material comprising black copper oxide, white titanium oxide, at least two of the oxides from the group iron oxide, cobalt oxide, nickel oxide and chromium oxide, and a flux of at least one of the following silicates: calcium silicate, calcium magnesium silicate, nepheline syenite, potash feldspar.

6. A composition material comprising at least 5% copper oxide, at least 5% titanium oxide, and the balance consisting in major proportions of at least two of the oxides taken from the group iron oxide, cobalt oxide, nickel oxide and chromium oxide, and a flux consisting of at least one of the following silicates: calcium silicate, calcium magnesium silicate, nepheline syenite, potash feldspar.

7. The method of forming a hard composition material which comprises mixing together black copper oxide and titanium oxide with parts of at least two of the oxides from the group including iron oxide, cobalt oxide, nickel oxide and chromium oxide in particle size such that they will pass a 400 mesh screen, calcining the mixture and after calcination grinding so that the material will again pass a 400 mesh screen forming it into finished product blanks by mixing with a suitable binder and pressing quantities of it in press equipment and firing the blank so formed to produce a homogeneous mass presenting a hard surface and having a uniform color throughout.

8. A method of forming a hard composition material which comprises mixing together selected size particles of black copper oxide and titanium oxide in minor proportion, and major proportion of at least two of the oxides from the group iron oxide, cobalt oxide, nickel oxide and chromium oxide of similarly selected particle size, so that the total mix is properly and uniformly blended, calcining the entire composition at a bright red heat for sufficient time so that every portion has been subjected to the full heat for at least an hour, grinding the calcining material in wet slip form so that it will again pass a 400 mesh screen, drying the slip, mixing the material with pressing aids and forming blanks from portions of the same by pressing, and then firing such blanks to a temperature between 2000° F. and 2200° F. to maturate the composition, whereby a hard, dense and uniform material simulating semi-precious stone is produced.

9. The method of forming a hard composition material which comprises mixing together black copper oxide and titanium oxide with parts of at least two of the oxides from the group including iron oxide, cobalt oxide, nickel oxide and chromium oxide in particle size such that they will pass a 400 mesh screen, calcining the mixture and after calcination grinding so that the material will again pass a 400 mesh screen, fluxing the calcined mixture by adding thereto a powdered siliceous flux, blending the mixture and flux, forming the composite body into finished product blanks by mixing the body with a suitable binder and pressing quantities of it in press equipment and firing the blank so formed to produce a homogeneous mass presenting a hard surface and having a uniform color throughout.

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