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POLISHING COMPOSITIONS

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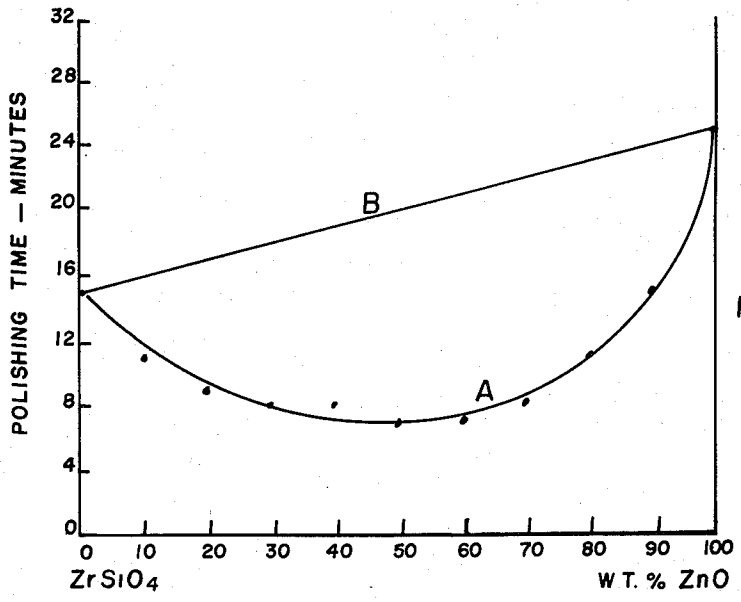

FIG. 1

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POLISHING COMPOSITIONS

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This invention relates to polishing compositions. It is particularly concerned with polishing compositions, useful for the polishing of glass, stone, and the like, that contain zircon.

It is an object of the invention to provide polishing compositions of the character described which have a rapid polishing action.

Another object of the invention is to provide polishing compositions of the character described which are inexpensive and easily prepared.

Other objects and advantages of the invention will be apparent from the following description thereof.

Zircon is a common and widely distributed mineral which chemically is zirconium orthosilicate ($ZrSiO_4$). Although zircon has been previously suggested as a polishing agent for glass it has not been used for this purpose in any substantial amounts because of the relatively long time required to obtain the desired degree of polish.

It has now been discovered that mixtures consisting essentially of zircon together with certain metal oxides as additives may be used in polishing glass, stone, and the like with unexpectedly favorable results. Among the most useful of such metal oxide additives are zinc oxide, ferric oxide, and cadmium oxide. The following example sets forth the preparation and manner of use in polishing glass of a preferred polishing composition comprising a zircon-zinc oxide mixture.

Example 1

A mixture of 50% zircon and 50% zinc oxide (ZnO) was made by thoroughly blending the two materials in finely divided form. The mixture obtained was then employed in the polishing of optical crown glass lens blanks by rubbing it over the surface thereof. The blanks were flat and had been previously ground to have a finish of 10–11 micro-inches. Polishing was carried out on a continuous feed, bowl type polishing machine operating at about 550 r.p.m. A conventional soft, felt polishing pad was employed and a pressure of 6 p.s.i. was used with an aqueous slurry of the above-mentioned mixture containing 10% solids being fed continuously onto the pad.

A number of polishing tests were made. In each case polishing was carried on until no more than 350 pits per sq. in. were observable on the lens surface when it was inspected with a 75× microscope. It was found that the average time required to obtain this degree of polish, regarded as acceptable by lens makers, was only 7 minutes. In contrast, it required 15 minutes using zircon by itself to obtain the same degree of polish. Using zinc oxide alone as the polishing material, the lens blank was not acceptably polished even in 25 minutes. It is thus evident that the combination of zircon and zinc oxide is a much more effective polishing composition than either of the two ingredients separately.

It has been demonstrated in numerous additional lens polishing tests carried out in the manner described above that mixtures of zircon and zinc oxide in other ratios also show an improved polishing efficiency over the ingredients used separately. This is illustrated in the following examples.

Example 2

A mixture consisiting of 40% zircon and 60% zinc oxide, both in finely divided form, was made and tested in the polishing of lens blanks by the procedure described in Example 1. It was found that only 7 minutes were required to obtain the desired degree of polish described in connection with Example 1.

Example 3

Powdered zircon and zinc oxide were thoroughly mixed in a 60:40 ratio and lens polishing tests like those described in Example 1 were carried out with the resultant composition. The predetermined degree of polish was obtained after only 8 minutes.

The accompanying drawing is a graphical chart on which the curve "A" represents the times required for polishing lenses in the manner described in Example 1 with zircon-zinc oxide mixtures in the ratios described in the foregoing examples and also in other ratios. It will be noted in the chart that 25 minutes has been arbitrarily chosen as the polishing time for zinc oxide alone. Actually a much longer period of time is required. It will also be observed that all points on curve "A" except the extremities thereof lie below the line "B" which represents the polishing time parameter established by drawing a straight line between the points representing the times (real and arbitrarily selected maximum) required for attaining the same degree of polish separately with zircon and zinc oxides, respectively.

It has also been found that improved polishing results are obtained when certain other oxides are mixed with zircon. This is illustrated by the following examples:

Example 4

A mixture of 75% powdered zircon and 25% finely divided cadmium oxide (CdO) was prepared and tested for lens polishing according to the procedure set out in Example 1. Only 6 minutes was required to obtain the same degree of polish with the mixture that required 15 minutes with zirconium silicate alone. Cadmium oxide by itself required more than 25 minutes to produce the same degree of polish.

Example 5

A 50–50 mixture of zircon and rouge (Fe_2O_3), both in finely divided form, was prepared. The resulting composition was used in lens polishing according to the procedure described in Example 1 and it was determined that the mixture in 10 minutes was as effective in polishing as zircon by itself in 15 minutes or the rouge alone in 16 minutes. With respect to polishing compositions consisting essentially of mixtures of zircon with cadmium oxide and zircon with ferric oxide (rouge), it is also found that the polishing times of such mixtures when graphically represented fall below the respective polishing time parameters established by constructing straight lines joining the polishing times of the zircon and the cadmium oxide and the zircon and the rouge.

Polishing compositions according to the present invention are useful not only for polishing lenses, but also for polishing television tube face plates and other glass articles as well as plate glass. Not only is the polishing efficiency of such compositions high with resultant savings in time, but there is also less tendency for the development of the well-known orange-peel effect which is sometimes encountered when using zircon by itself. It has also been found that compositions according to the present invention give excellent results in polishing dense stone such as granite and marble.

In using the present novel compositions they may be

dispersed in any desired and suitable liquid suspending medium. In the tests described above, water alone produced good results as a suspending medium. However, liquid media containing deflocculants, thickeners, and the like may also be used.

The procedure employed in polishing with the novel compositions herein disclosed is subject to wide variation. Although the tests described hereinabove were, for purposes of comparison, carried out with a soft polishing pad and a moderate pressure, polishing compositions according to the invention may be advantageously used under other conditions. Thus, the time required when using a hard pad to obtain a predetermined degree of polish with zircon by itself is much greater than the time required with polishing compositions in accordance with the present invention. For example, in the case of a comparison of zircon with zircon-zinc oxide mixtures the time ratio may be as great as 2:1, i.e. 100% greater time for zircon when used alone.

The zircon and the metal oxide additives with which the present invention is concerned are, of course, very finely divided since the presence in a polishing composition of a substantial number of particles having an average diameter greater than about 5 microns is likely to result in the production of scratches on the surface being polished. In general, a particle size below about 3 microns average diameter is desired and it is preferred that most of the particles have average diameters not greater than about 2 microns.

Zircon can be easily milled to the desired particle size and the impurities present in minor amounts do not materially affect the polishing action. The metal oxide additives employed may also be commercially available materials, extreme purity not being essential. In this connection, it has been found that excellent results are obtained with polishing compositions consisting essentially of zircon and a plurality of the metal oxide additives of the group described above. For example, a composition consisting essentially of 40% zircon, 10% Fe_2O_3 and 50% ZnO when tested in the manner described in Example 1 polished a lens blank acceptably in only 8 minutes. Further, it has been found that the addition of small amounts of other glass polishing agents such, for example, as zirconia, do not materially interfere with the action of polishing compositions according to the invention. Thus, a polishing time of only 8 minutes was required when using the procedure of Example 1 and a polishing composition consisting essentially of 40% zircon, 10% ZrO_2 and 50% ZnO.

It will be evident from the foregoing that polishing compositions consisting essentially of zircon and at least one metallic oxide additive selected from the group consisting of ZnO, Fe_2O_3 and CdO are extremely useful in the polishing of glass, stone and the like throughout the range from about 10% to about 90% zircon. All percentages and ratios referred to herein are percentages and ratios by weight.

We claim:

1. A composition adapted for use in liquid suspension in polishing glass, stone, and the like which consists essentially of a mixture of finely divided zircon and at least one finely divided, metallic oxide additive selected from the group consisting of ZnO, Fe_2O_3 and CdO.

2. A composition as set forth in claim 1 in which said zircon comprises from about 10% to about 90% of said composition.

3. A composition as set forth in claim 2 in which said additive comprises ZnO.

4. A composition as set forth in claim 2 in which said additive comprises Fe_2O_3.

5. A composition as set forth in claim 2 in which said additive comprises CdO.

6. A process for polishing glass, stone and the like which comprises rubbing the surface thereof with a liquid suspension of a polishing composition which consists essentially of a mixture of finely divided zircon and at least one finely divided, metallic oxide additive selected from the group consisting of ZnO, Fe_2O_3 and CdO.

7. A process as set forth in claim 6 in which said zircon comprises from about 10% to about 90% of said composition.

8. A process as set forth in claim 7 in which said additive comprises ZnO.

9. A process as set forth in claim 7 in which said additive comprises Fe_2O_3.

10. A process as set forth in claim 7 in which said additive comprises CdO.

11. A composition as set forth in claim 2 in which said additive consists essentially of ZnO.

12. A process as set forth in claim 7 in which said additive consists essentially of ZnO.

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