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PROCESS OF METALLIZING SURFACES

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This invention relates to the coating of surfaces with metal.

Various methods have heretofore been proposed for the coating of non-metallic surfaces, such as glass, mica, porcelain, earthenware or other electrical insulating materials with a fired-on coating of noble metals, in particular, of silver. In British patent specification No. 566,718, a process of silvering a non-metallic article is proposed which consists in applying to the article by painting, spraying or printing, a paste consisting of finely divided metallic silver and a fusible flux in a combustible organic medium, the coated article being then fired to burn away the organic medium so as to leave a firmly adhering layer. The finely divided metallic silver is obtained in the examples described in the aforesaid specification by the reduction of silver oxide and after the oxide is reduced to metallic silver the resulting powder is washed and dried and then mixed with the flux and the mixture ground in the combustible organic medium to form the paste which is then applied to the article.

In applying the aforesaid process to the coating of sheets of mica for use in the construction of electrical condensers, it is necessary to ensure that the resultant coating has a uniform conductivity and has good adhesion to the surface of the mica sheet. In the aforesaid specification, the finely divided metallic silver is prepared and then incorporated in the organic medium by the use of a grinding process which it is found tends to cause aggregation of the finely divided silver owing to the malleable nature of the metal and hence it is difficult to obtain a good dispersion of the metallic silver in the organic medium which ensures a uniformly-conducting and firmly adherent coating.

One of the objects of the present invention is to provide an improved method of making a paste for use in coating surfaces with noble metal with a view to overcoming or reducing this difficulty.

According to one feature of the invention, there is provided a method of making a paste for the coating of surfaces with metal, comprising finely divided noble metal in a combustible organic medium, which includes the step of converting a compound of the noble metal into said metal in said combustible organic medium. In this manner, it is possible to obtain a good dispersion of finely divided metal without the necessity of employing a grinding process.

The term "noble metal" as used in connection with the present invention, means silver, gold, platinum, palladium, iridium, ruthenium, osmium or rhodium.

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In the aforesaid specification, the flux proposed is lead borosilicate which is likewise ground with the metallic powder. Here, again, it is difficult to obtain a good dispersion of the flux throughout the organic medium owing to the grinding process, particularly having regard to the fact that the quantity of flux employed is a relatively small proportion of the total content.

According to another feature of the invention, there is provided a method of making a paste for the coating of surfaces with metal, comprising finely divided noble metal in a combustible organic medium, which includes the step of incorporating in said paste ingredients in solution such that upon subsequent firing of a surface coated with said paste, said ingredients react with one another to form a flux. In this way, it is possible to obtain good dispersion of the flux on the said surface.

It is preferred to employ an oxide of a noble metal which is subsequently converted into finely divided metallic powder although it is possible that other compounds or salts of the metal may be employed. The invention is applicable to the coating of surfaces with any of the noble metals although the preferred metal to employ is silver, particularly where the invention is applied to the coating of mica sheets for the manufacture of electrical condensers.

In order to maintain the finely divided metal dispersed throughout the combustible organic medium, particularly in cases where the paste ultimately formed is not required for immediate use, it is preferred to add a stabilising agent which may be of the naphthalene sulphonic acid type to maintain the metal powder in suspension.

In one example of applying the invention to the preparation of a paste for silvering mica sheets, 80 parts by weight of colophony, preferably W. W. rosin, and 70 parts of turpentine are heated together to about 150° C. to produce a clear solution of the rosin. A stabilising agent is then added. The stabilising agent may be of the naphthalene sulphonic acid type, of which 0.4 part by weight dissolved in turpentine are added to the clear solution, the solution being filtered thereafter, if necessary. A suspension of 250 parts by weight of pure silver oxide in a suitable quantity of turpentine is then prepared by grinding the oxide with a suitable quantity of turpentine to obtain a good dispersion of the oxide, which not being malleable can be ground without aggregation of the particles, and the suspension is then stirred into the rosin solution, whereupon the silver oxide is reduced to metallic silver by the rosin which acts as a reducing agent. This reac-

tion is exothermic and it is essential that the addition of the silver oxide suspension to the rosin solution should be carried out very slowly to avoid the risk of igniting the turpentine. For the quantities mentioned above, the step of adding the silver oxide to the rosin solution should extend over about half an hour. During the reaction, the temperature of the mixture is maintained at about 150° C. by the exothermic reaction and when all the silver oxide has been added, heating at this temperature is continued for about 15 minutes to ensure completion of the reaction.

A suitable flux, for example lead borate or lead borosilicate, may be added to the paste resulting from the above-described procedure, but it is preferred to incorporate in the paste ingredients in solution which, after application of the paste to a surface and the firing of the surface, react with one another to form a flux. In this way, it is possible to obtain a good dispersion of the flux on the coated surface. For example, if it is desired to employ lead borate as the flux, litharge and boric oxide may be stirred into the paste. Suitable quantities for the particular example described above are 3 parts by weight of boric oxide dissolved in alcohol, and 9.7 parts by weight of litharge. The litharge reacts with the rosin to form lead resinate which is soluble in the turpentine. When the paste containing these ingredients is applied to a surface and the surface is fired, the lead resinate is reduced to oxide of lead which reacts with the boric oxide to form lead borate. The flux-forming ingredients may be added to the organic combustible medium at any stage in the preparation of the paste, preferably prior to the addition of the silver oxide.

The paste made as described above is applied, for example, to both sides of mica sheets for use in the manufacture of condensers, by spraying and after allowing a short period for air drying the plates are fired, the firing operation being effected by gradually heating to about 500° C. to 550° C. During the first firing operation, the lead resinate is converted to oxide of lead which reacts with the boric oxide to form a lead borate flux.

Instead of using lead borate as a flux, lead borosilicate may be employed, and for this purpose litharge, boric oxide and ethyl silicate may be added to the mix. The lead resinate formed by the reaction of the litharge and resin is converted during the firing operation to oxide of lead, which reacts with the boric oxide and with the silica obtained during the firing from the ethyl silicate, to form lead borosilicate. If preferred, instead of forming lead resinate in the manner described, lead resinate powder may be added to the medium prior to the addition of the silver oxide. Whilst it is preferred to add flux-forming ingredients to the mix, it is possible, however, in some cases, to add finely divided powdered lead borate or borosilicate to the mix. Other fluxes may, of course, be employed.

If desired, the stabilising agent may be added to the mix after the addition of the silver oxide.

Although the invention has been described above as applied specifically to coating of mica sheets with silver, it will be understood that the invention is generally applicable to the coating of surfaces with any of the noble metals. Moreover, combustible organic medium other than turpentine may be used, for example the substance known as "turps sub."

I claim as my invention:

1. A process of metallizing a surface of a heat resistant material with a noble metal to obtain a uniform conducting and firmly adherent coating comprising, first, mixing together thoroughly a suspension of a reducible compound of said noble metal and a solution of an organic reducing agent for said noble metal compound in a combustible organic solvent for said reducing agent, second, providing said mixture with ingredients which will react at high temperatures to form a flux for said noble metal, third, maintaining said mixture at a temperature required for said noble metal compound to be reduced by said reducing agent until the reaction is complete and a dispersion of said metal has been formed, fourth, applying the mixture thus formed to said surface and, fifth, firing the mixture on said surface at an elevated temperature to form said flux by the reaction of said ingredients and to burn off the organic constituents until an adherent coating of the noble metal has been formed on said surface.

2. A process according to claim 1 in which said noble metal compound is silver oxide, said reducing agent is colophony, and said combustible organic solvent is turpentine, and in which the suspension of silver oxide in turpentine is slowly added to the solution of colophony in turpentine and the mixture is maintained at a temperature of about 150° C. until the oxide has been completely reduced and a good dispersion of silver has been formed throughout the liquid.

3. A process according to claim 1 in which the flux forming ingredients are lead resinate and boric oxide which react to form lead borate.

4. A process according to claim 1 in which the flux forming ingredients are lead resinate, boric oxide and ethyl silicate which react to form lead borosilicate.

5. A process according to claim 1 in which the stabilizing agent consisting of napthalene sulphonic acid is added to the mixture before said mixture is applied to said surface.

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