Abstract Title: **Coating a surface to provide a highly reflective surface**

The surface of an object which may be metallic e.g. aluminium or steel is coated by applying a primer and then applying a slurry comprising between 0.002% and 2% of a flake dispersed in a liquid and curing the slurry. The flake may be non-leafing and metallic e.g. aluminium or non-metallic e.g. mica. The primer may be a dark colour such as black or dark blue or dark green and may be applied by a powder or spray coating process, which may be in two stages and then baked. A lacquer may be applied by spraying or powder coating after the slurry has cured. The slurry may be a metallisation slurry which is diluted with a solvent thinner. The slurry may contain a lacquer component. A highly reflective surface may be provided.

The print reflects an assignment of the application under the provisions of Section 30 of the Patents Act 1977.
1. Provide object

2. Apply first powder coat and bake

4. Apply second powder coat and bake

6. Allow object to cool to under 100 C

8. Apply slurry and bake

10. Allow object to cool

12. Apply lacquer coat and air dry

14. Bake Lacquer
Method of Coating a Surface

The present invention relates to a method of coating a surface, in particular to a method of coating a surface of metal objects to provide a highly reflective surface finish. This method is particularly intended for use in the powder coating industry.

It is often desirable when producing an object to provide the surface of the object with a highly reflective surface finish. There are several different ways in which such a highly reflective finish can currently be achieved.

Polishing the surface of the object can provide a highly reflective finish, but it is time consuming to produce an acceptable finish and such a finish may be easy scratched or damaged. Electro-plating the surface of an object with a reflective metallic finish, such as chrome plating, can also provide such a finish, but is energy intensive and often involves hazardous chemicals. Electro-plated objects are also vulnerable to the plating layer being chipped or otherwise accidentally removed. It is also known to use a vacuum metallisation process to deposit a layer of metal onto the surface of the object to provide a highly reflective finish, but this involves specialised vacuum metallisation equipment to create the low pressures required and this specialist equipment increases the cost of the process.

It is an object of the present invention to provide a more convenient method for coating a surface of an object.

According to the invention there is provided a method for
coating a surface of an object, the method comprising the steps of:
  providing an object having a surface to be coated;
  preparing the surface to be coated by applying a primer coating using a powder coating process;
  applying to said surface a slurry, the slurry comprising between 0.002% and 2% of a flake dispersed in a liquid; and
curing the slurry.

According to the invention there is also provided a method for coating a surface of an object, the method comprising the steps of:
  providing an object having a surface to be coated;
  preparing the surface to be coated by applying a primer coating, the primer coating being substantially black;
  applying to said surface a slurry, the slurry comprising between 0.002% and 2% of a flake dispersed in a liquid; and
curing the slurry.

The invention also provides a method for coating a surface of an object, the method comprising the steps of:
  providing an object having a surface to be coated;
  preparing the surface to be coated by applying a primer coating;
  applying to said surface a slurry, the slurry comprising between 0.002% and 2% of a flake dispersed in a liquid, the liquid comprising at least 35% xylene; and
curing the slurry.

The flake dispersed within the liquid is preferably a metallic flake and is preferably a non-leafing flake, but can be any suitable form of flake, for example mica or other
flake. A non-leafing metallic flake is preferred as it disperses throughout the liquid rather than floating upon it and this has been found to produces a more consistent surface finish.

The flake is preferably an aluminium flake, but can be of any other suitable flake material depending upon the surface finish desired. With an aluminium flake the finished surface is typically highly reflective and silver in colour, similar to a chrome finish achieved through chrome plating.

Being able to apply the slurry directly to the surface to be coated by, for example, spraying provides a convenient application of the slurry. The proportion of flake within the slurry is between 2% and 0.002% and is preferably less than 0.1% flake. It is preferred that the liquid medium of the slurry is made up of liquids commonly used as solvents. The use of solvents as the dispersion medium for the slurry and a low concentration of flake provides a cheap slurry which can be easily applied to provide a fine layer of flake across the surface to be coated. Solvents are typically volatile and therefore evaporate easily allowing for easy curing of the slurry. Solvents also typically have a low viscosity and therefore allow for a more rapid dispersion of the flake.

We have found that a suitable slurry can be formulated by starting with a vacuum metallisation slurry and then diluting it with solvent thinners. A particularly suitable vacuum metallization slurry has been identified which comprises a non-leafing aluminium flake (10%) in a mixture of ethyl acetate (45%) and isopropyl acetate (45%). It should be
understood that the slurry of the present method can be created by using a single chemical as the liquid, mixtures of chemicals or otherwise.

The thinners used to dilute the vacuum metallisation slurry to form the slurry of the present invention may be any suitable solvent. Suitable solvents include xylene, n-butyl acetate and 2-methoxy-1-methylethyl acetate or a mixture of these and/or other solvents.

A particularly preferred mixture is a mixture comprising at least xylene, n-butyl acetate and 2-methoxy-1-methylethyl acetate. The mixture preferably comprises at least 35% xylene and most preferably between 40% and 70 xylene. It is preferred that the mixture comprises at least 17% n-butyl acetate and at least 8.5% 2-methoxy-1-methylethyl acetate.

The slurry preferably also comprises a lacquer component, without a hardener, for example a clear lacquer added to the slurry. Preferably between 1-7 drops of the clear lacquer are added to the slurry for each 600mls of slurry, most preferably 4 drops of lacquer are used.

The surface finish relies upon the quality of the surface to be coated and the surface is therefore prepared before the slurry is applied. The surface to be coated is prepared by applying a primer coating. The primer coating is preferably a dark colour such as dark blue, but is most preferably substantially black. The primer coating preferably has a gloss level of greater than 50%, preferably greater than 75% and most preferably greater than 89%.
The method preferably further comprises the step of applying a lacquer over the surface after the slurry has been cured. The lacquer may include a dark blue tint which helps to reduce the appearance of a white surface tinge to the lacquer. The lacquer may be applied by a powder coating process, or other suitable process such as spraying.

This coating method has been developed specifically for use as a coating to enhance a powder coated finish to an item. It is therefore preferred that the primer coating is applied by a powder coating method in which a fine powder is applied to the surface of the item and the powder is then baked so that it bonds to the surface. It is preferred that a second powder coat is applied over the first powder coat. Powder coating is a quick and effective method of producing a hardwearing surface coating. It is particularly preferred that the two coats are applied as follows:

the first powder coat is applied to the surface of the item using a substantially black powder;

the item and first powder coat are baked for between 15 and 25 minutes;
second powder coat is applied over the first powder coat using a substantially black powder;
the item, first powder coat and second powder are baked to cure the powder coats.

It should be understood that the term substantially black is used herein to refer to any dark colour or shade. For example, a dark blue or dark green may also be suitable. The final finish of the surface depends upon the colour of the primer and it has been found that a substantially black primer coating produces good results. It is preferred that
the primer is substantially black, but with up to 15% of a different colour, for example white.

Preferably the powder used for at least the second powder coat is a mixture of powders comprising between 5-15% by volume of substantially white powder with the remainder being a substantially black powder. Such a mixture may also be used for the first powder coat.
The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows a flowchart of a powder coated primer coating method; and

Figure 2 shows a flowchart of a spray painted primer coating method.

A typical coating method 1 including a powder coated primer coating is shown in Figure 1. At box 2 an object is provided having a surface to be coated. For a steel object first powder coat is applied to the surface in box 4 and the object and powder coat are baked at between 180 and 190°C for 25 minutes. A second powder coat is then applied and the object and two powder layers are baked at between 180 and 190°C for 45 minutes. For an aluminium object, the object is preheated for 45 minutes at between 180 and 190°C before the first powder coat is applied and the second coat is applied after only 5 minutes.

The powder used in this process is a black gloss powder with a gloss rating of 90%+, in this case the powder is PGX5046/90%+Gloss from PCS Powders™.

It should be noted that the baking schedules and temperatures may need to be altered depending upon the powder being used and the manufacturer’s instructions for baking. It should be noted that under-baking of the powder coating layers will result in the final reflectivity of the finish being reduced by up to 50%.
The object is then allowed to cool to below 100°C in step 8. Slurry is the applied to the surface and the object baked for 45 minutes at 160°C in step 10. The slurry is applied from a small tip, HVLP spray gun from no closer than 6 inches from the surface until the required coverage is achieved.

In this case, the slurry is made from thinning a vacuum metallization slurry with two different solvent thinners. The vacuum metallisation slurry comprises a lamellar, non-leafing aluminium flake (10%) in a solution of ethyl acetate (45%) and isopropyl acetate (45%). Such a vacuum metallisation slurry is sold by Wolstenholme™ International Ltd under the trade name Metasheen™ Slurry HR0800 or HR+. The thinners that are used comprise a xylene based thinner containing 75-100% xylene such as that supplied by Witham Oil and Paint Ltd as TH2™ Thinners and a mixed thinner comprising n-butyl acetate (50-60%), 2-methoxy-1-methylethyl acetate (25-30%), xylene (7-10%), butylglycol acetate/2-butxyethyl acetate (2-3%), ethylbenzene (1-2%) and 2-methylpropyl acetate (0.1-0.2%) such as that sold by MaxMeyer™ under the product number 1.911.4310. The vacuum metallisation slurry is mixed with the thinners as follows 5 mls vacuum metallisation slurry, 350 mls xylene thinners and 250mls mixed thinners. Four drops of a clear lacquer (without hardener) is also added to the slurry. It has been found that this formulation of slurry does not result in the formation of a white residue when the slurry is cured.

Once baked, the object is allowed to cool to room temperature in step 12. A clear lacquer is then applied and allowed to air dry for 10 minutes in step 12. In this case the lacquer
is a clear coat such as that manufactured by Carrs Paints™.

The lacquer coat is then baked at 120-150°C for a minimum of 45 minutes. It should be noted that the reflective finish can be reduced by up to 15% if the lacquer is not allowed to air dry before the baking is started.

It should be understood that the baking schedule for the powders outlined above is only indicative, and that other schedules could be used depending upon the manufacturers suggestions.

Figure 2 shows a typical coating method 101 including a spray painted primer coating. At box 102 an object is provided having a surface to be coated. A first paint layer is applied by spraying onto the surface from a small tip HVLP spray gun. The paint layer is allowed to air dry for 10 minutes and the paint is then cured at 60°C for 20 minutes. A second coat of paint is applied and air dried for 20 minutes before final curing of the paint layers.

The paint used in this process is a black gloss paint with a gloss rating of 90%+. Such a paint is available from Ketts Auto Paints under the product code RJ15.

It should be noted that the baking schedules and temperatures may need to be altered depending upon the paint being used and the manufacturer’s instructions for curing. It should be noted that not curing the paint sufficiently may result in the final reflectivity of the finish being reduced.

The object is then allowed to cool to room temperature in
step 108. Slurry is the applied to the surface and the object baked for 10 to 20 minutes at 40°C in step 110. The slurry is applied from no closer than 8 inches and should be sprayed in a wide fan and a second air jet should be used to air dry the slurry before baking.

The slurry is the same as the slurry use in the powder coated primer coating method 1 of Figure 1.

Once baked, the object is allowed to cool to room temperature in step 112. A clear lacquer is then sprayed onto the surface and allowed to air dry for 10 minutes in step 112. In this case the lacquer is an acrylic lacquer.

The lacquer coat is then cured in step 116. It should be noted that the reflective finish can be reduced by up to 15% if the lacquer is not allowed to air dry before the baking is started.

It should be understood that the invention has been described above by way of example only and that modifications in detail may be made without departing from the scope of the invention as described in the claims. In particular the amounts and concentrations listed above may be varied slightly.
Claims

1. A method for coating a surface of an object, the method comprising the steps of:
   providing an object having a surface to be coated;
   preparing the surface to be coated by applying a primer coating using a powder coating process;
   applying to said surface a slurry, the slurry comprising between 0.002% and 2% of a flake dispersed in a liquid; and
   curing the slurry.

2. A method as claimed in claim 1, in which the flake is non-leafing.

3. A method as claimed in claim 1 or claim 2, in which the flake is an aluminium flake.

4. A method as claimed in any preceding claim, in which the slurry is sprayed onto the surface to be coated.

5. A method as claimed in any preceding claim, in which the primer coating has a gloss level of greater than 79%.

6. A method as claimed in claim 5, in which the primer coating has a gloss level of greater than 89%.

7. A method as claimed in claim 5 or claim 6, in which the primer coating is substantially black.

8. A method as claimed in any preceding claim, in which the method further comprises the step of applying a lacquer to the surface after the slurry has been cured and then the
further step of curing the lacquer

9. A method as claimed in claim 8, in which the lacquer includes a dark blue tint.

10. A method as claimed in any of claims 5 to 7, in which the primer coating is applied by powder coating in at least two coats.

11. A method as claimed in claim 10, in which the primer coating applied as follows:
   applying a first powder coat to the surface of the item using a substantially black powder;
   baking the item and first powder coat for between 15 and 25 minutes;
   applying a second powder coat over the first powder coat using a substantially black powder;
   baking the item, first powder coat and second powder coat to cure the powder coats.

12. A method as claimed in claim 10 or claim 11, in which the powder used for at least the second powder coat is a mixture of powders comprising between 5-15% by volume of substantially white powder with the remainder being a substantially black powder.

13. A method as claimed in any preceding claim, in which the slurry contains less than 0.1% flake.

14. A method for coating a surface of an object, the method comprising the steps of:
   providing an object having a surface to be coated;
preparing the surface to be coated by applying a primer coating, the primer coating being substantially black;
applying to said surface a slurry, the slurry comprising between 0.002% and 2% of a flake dispersed in a solvent mixture; and
curing the slurry.

14. A method for coating a surface of an object, the method comprising the steps of:
providing an object having a surface to be coated;
preparing the surface to be coated by applying a primer coating;
applying to said surface a slurry, the slurry comprising between 0.002% and 2% of a flake dispersed in a liquid, the liquid comprising at least 35% xylene; and
curing the slurry.

15. A method substantially as herein described with reference to the accompanying drawings.

16. An object including a coating created using a method as claimed in any preceding claim.
**Application No:** GB0426833.0  
**Examiner:** Robert Mirams  
**Claims searched:** 1 to 13, 15 (in part) and 16 (in part)  
**Date of search:** 17 March 2005

**Patents Act 1977: Search Report under Section 17**

**Documents considered to be relevant:**

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**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC:

- B2E
- Worldwide search of patent documents classified in the following areas of the IPC:
  - B05D; C09D
- The following online and other databases have been used in the preparation of this search report:
  - WPI, EPDOC, JAPIO