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(57) Abrégé/Abstract:
A process for the sequential coating of an object with at least one undercoat and then at least one pigmented topcoat is disclosed. The undercoat is formed by admixing at least two compositions to form the undercoat, the compositions having different reflectance values and having a colour selected from white, grey and black. The admixing is controlled so that the undercoat composition has a reflectance value of ±10, preferably ±5, units of the reflectance value of the topcoat. The process reduces the number of coatings or the amount of film build of topcoat in order to achieve efficient colour match of topcoat. The process is particularly useful in the automotive industry, especially the refinish portion of that industry.

ABSTRACT OF THE DISCLOSURE

A process for the sequential coating of an object with at least one undercoat and then at least one pigmented topcoat is disclosed. The undercoat is formed by admixing at least two compositions to form the undercoat, the compositions having different reflectance values and having a colour selected from white, grey and black. The admixing is controlled so that the undercoat composition has a reflectance value of ±10, preferably ±5, units of the reflectance value of the topcoat. The process reduces the number of coatings or the amount of film build of topcoat in order to achieve efficient colour match of topcoat. The process is particularly useful in the automotive industry, especially the refinish portion of that industry.

COLOUR-MATCHING OF COATINGS

The present invention relates to the colour matching of coatings in a process of coating objects with an undercoat and a pigmented topcoat. In particular, the invention relates to a process in which the reflectance of the undercoat and topcoat are matched to improve the efficiency of the colour matching and in which the undercoat is white, grey or black, but not otherwise coloured by pigment. As used herein, "undercoat" refers to the combination of layers of primers, sealers and other coatings underneath the outer or topcoat on an object.

The coating of objects, including metal and plastic objects with pigmented coatings is well known, a major example being the application of topcoats in the automotive industry. One or more undercoats e.g. primer and sealer, are applied to the object, followed by one or more topcoats. Usually a plurality of coatings of a topcoat are applied. One of the principal reasons for the application of a number of coatings of topcoat is to achieve a highly uniform coating of the object, especially with respect to the colour of the object. This is especially critical in the automotive industry, where the coatings are subjected to a wide variety of extreme lighting conditions and consumers demand high quality in the consistency of colour between different parts of the automobile.

The problems of differing opacifying power of topcoats, especially different colours of topcoats, is discussed in U.S. Patent 4 876 111 of D. Guyomard et al, which issued 1989 October 24. Grey was stated to be an unsatisfactory colour for the undercoat in view of the poor opacifying characteristics of some colours,

specifically yellow and red. The method disclosed by D. Guoyomard et al to overcome the opacifying problem was to blend a pigmented paste with a neutral primer base to form a pigmented undercoat, which was then applied to the object, the pigmented paste being selected on the basis of a classification of the colour of the topcoat.

Although the use of pigmented undercoats may offer a solution to poor opacifying power of pigments, the wide variety of colours of automobiles would require a substantial inventory of pigmented pastes to enable a range of colours of undercoat to be produced as demanded by the colour of the topcoat, as well as a need to select an appropriate undercoat colour for efficient colour matching with the topcoat. This would be especially critical in automobile repair operations i.e. the automotive refinish industry. That industry must colour match refinished objects to remaining sections having the original colour of the automobile on an individual unit basis i.e. for each automobile passing through the refinish operation. Problems of contamination of colours from one undercoat to the next would also exist.

It has now been found that undercoats that are white, grey or black in colour, without coloured pigments, enable efficient colour matching of the topcoat to be achieved, reducing both inventory and contamination problems.

Accordingly, the present invention provides a process for the sequential coating of an object with at least one undercoat and then at least one pigmented topcoat, in which the pigmented topcoat has a reflectance value of "R", said undercoat and topcoat being comprised of polymers in carrier liquids, comprising the steps of:
(a) mixing at least two compositions together to form the undercoat, each of said compositions being comprised

of polymers in carrier liquids and having different reflectance values, each of said compositions having a colour selected from the group consisting of white, grey and black;

(b) controlling the blending of the compositions under (a) so that the undercoat composition has a reflectance value within ±10 units of the reflectance value, "R", of the topcoat; and

(c) applying the composition of (b) to the object followed by the composition of the pigmented topcoat.

In a preferred embodiment of the process of the invention, the compositions used to form the undercoat composition are different shades of grey.

In another embodiment, the compositions used to form the undercoat are formed by admixing a black composition with a white composition.

In yet another embodiment, the compositions used to form the undercoat are formed by admixing a translucent sealer with white, grey and/or black tint compositions.

Reflectance is a measure of the amount of light reflected by a surface, the present invention being concerned with light in the visible spectrum i.e. light with wavelengths in the range of approximately 400 to 700nm. A coloured material reflects light of its own hue and absorbs light of other hues. Measurement of reflectance results in a spectral reflectance curve; as used herein, reflectance "R" is the peak value on the spectral reflectance curve. Apparatus for the measurement of reflectance are understood to typically measure the spectral reflectance curve at more than one angle, although the actual angles used may differ. Reflectance is measured on a scale of 0-100, with white having a value of 100 and black a value of 0; values above 100 may be obtained at some angles of measurement

i.e. at or near the specular angle (the specular angle being 90° to the incident light source of the measuring device), due to presence of aluminum flakes in some topcoats, and such angles should not be used in reflectance measurements pertaining to the present invention.

The reflectance values may be determined on a colour analyzing apparatus; an example of commercially available apparatus is a Macbeth Color-Eye® 5010 Goniospectrophotometer. Techniques of coating undercoats and especially topcoats onto test panels to a consistent colour are well known and frequently used in test laboratories.

The process of the present invention relates to the colour matching of undercoats and topcoats on coated objects, and especially to a simple and practical method of achieving matched colours. The process requires the use of undercoats that are white or various shades of grey, including very dark grey, or black, regardless of the colour of the topcoat. This is achieved by matching the reflectance of the undercoat to that of the topcoat.

The preparation of undercoats having a range of reflectance values may be illustrated by the following procedure, using three undercoat compositions. In this illustration, the first undercoat is white, the second undercoat is medium grey and the third undercoat is a very dark grey. To prepare the range of undercoats, the first and second undercoats are mixed in two differing proportions e.g. 2:1 and 1:2. Likewise, the second and third undercoats are mixed in two differing proportions e.g. 2:1 and 1:2. The reflectance values are then measured on the resultant seven undercoat compositions; the reflectance values would range from low values e.g. approximately 10, to high values e.g. approximately 90,

the actual values depending on the three undercoat compositions originally selected and the mixing proportions. A plurality of panels of a material appropriately similar to the object to be coated are coated with each of the undercoat compositions, and dried.

To further illustrate the invention, a series of panels coated with the topcoat composition may be prepared; the series involves coating panels that have been coated with an undercoat composition with different numbers of coatings of a selected topcoat, so that for a particular undercoat a series of panels coated with one coating of topcoat, two coatings of topcoat, three coatings of topcoat etc. are obtained. Each topcoat is air dried before application of the next top coat. L,a,b measurements are made on all panels; persons skilled in the art will appreciate that other colour measurement classifications may be used. For each undercoat, the L,a,b values will vary with increasing number of coatings of the topcoat, and tend towards a constant L,a,b value. The constant L,a,b value indicates the minimum number of topcoats required for that particular undercoat in order to achieve an acceptable coating. Repeating the process for the different undercoats will reveal the preferred undercoat i.e. the one giving an acceptable topcoat with the minimum number of coats i.e. minimum film build, of the topcoat. While this illustration has been described with reference to L,a,b measurements, it should be understood that some skilled persons may be able to achieve the same result through visual observations.

In practice, the full procedure described above as an illustration would not be necessary. The reflectance of the topcoat is predetermined, either because the topcoat being applied must match adjacent coatings on the

object, or because a customer has selected a particular topcoat for the object. The requirement then becomes a matter of matching of the reflectance "R" of the topcoat to that of the undercoat. The reflectance of the undercoat and topcoat should be within ±10 reflectance units, especially within ±5 reflectance units, on the 0-100 scale described above; if the undercoat and topcoat have differing reflectance values, it is preferred that the undercoat have the lower reflectance value.

The supplier of the topcoat could provide a reflectance value, "R", for the topcoat, or a code related to the reflectance value for the topcoat, based on laboratory testing prior to shipment to the customer. Using mixing apparatus and guidelines provided by the supplier of the undercoat, the customer that is applying the topcoat could then select or mix the undercoat composition to provide an undercoat that enables an efficient colour match of the topcoat. Such mixing could be from two undercoat compositions, of very high and very low relectance characteristics e.g. a white and a very dark grey or black undercoat composition, but is more conveniently carried out by mixing two undercoat compositions from a selection of two or more undercoat compositions that cover the range of reflectance values. Alternatively, the procedure illustrated above could be conducted on a relatively small selection of undercoats, based on the nature of the topcoat being applied, to give the undercoat requiring the minimum number of coatings of topcoat.

The undercoat compositions used in the invention are intended to be white, a shade of grey or black, without any coloured pigments that assist in the matching of the colours of the undercoat and the topcoat. While minor amounts of a coloured pigment may be added, they may or

may not assist in the colour matching of the topcoat, and may have detrimental effects on and increase the complexity of the colour matching.

The admixing of the compositions that form the undercoat is carried out to provide a undercoat with the required degree of reflectance. The admixing may be done on a batch basis, with appropriate adjustments being made during the mixing step so as to obtain an undercoat of the required reflectance. Alternatively, the mixing may be done on a continuous basis, with tests being conducted periodically for purposes of monitoring, and adjustment as required, of the reflectance of the undercoat.

Both the undercoat and topcoat will normally be in the form of a polymeric component in a carrier liquid. The polymeric component is also known as resin or binder, and catalysts and other additives may also be added to the compositions, as will be appreciated by persons skilled in the art. The carrier liquid may be an organic solvent, the polymeric component being in the form of a solution or dispersed in the liquid. Alternatively, the carrier liquid may be an aqueous solution, in which event the polymeric component will normally be in the form of a dispersion. In another embodiment, the topcoat may be in the form of a powder. The topcoat will normally also contain pigments. The undercoat may or may not contain pigments in minor amounts.

The undercoat and topcoat may be applied using spraying techniques, as will be understood by persons skilled in the art. Alternatively, especially for the undercoat, the coating may be applied by electrodeposition techniques. Other coating techniques may also be used.

The method of the present invention may be used in the coating of objects in which a undercoat and a topcoat

are applied. In particular, the process may be used in the automotive industry, and especially in the refinish or repair portions of the automotive industry.

The use of the fewest number of topcoats, or minimal film build, to achieve an acceptable coating has a number of benefits to the operator of the coating line e.g. in a repair or refinish coating operation. For instance, fewer coatings (or less film build) means that less topcoat is required in order to obtain the acceptable coating, which is a savings in terms of both the cost of the topcoat and the time required i.e. the time to apply the required number of coatings is reduced. The ability to be able to prepare undercoats from a small number of undercoat compositions, being two or more but preferably three, simplifies the inventory and operational problems for the repair or refinish operator while still permitting efficient and acceptable use of possibly hundreds of different topcoats.

The present invention is illustrated by the embodiments shown in the following examples:

Example I

A series of undercoats were prepared by admixing two compositions that were white and medium grey or medium grey and very dark grey in colour. A total of seven undercoats were prepared, having reflectance values of from approximately 10 to 85.

A red metallic automotive topcoat was selected for testing. When tested for reflectance, this topcoat had a reflectance "R" of 20. This value of reflectance was intermediate between undercoat # 6 having a reflectance of 15 and undercoat #5 having a reflectance of 25. In the absence of preparation of another undercoat with a reflectance more closely matching that of the topcoat, it would therefore be expected that undercoat #6 would be

the preferred undercoat.

A series of 21 panels were prepared, in three sets of seven, from undercoats #5 and 6 above, and from undercoat #7 which had a reflectance of 10. One panel of each set was coated with two coats of the red metallic topcoat. Similarly, one panel from each set was coated with from three to eight coats of the topcoat, such that all 21 panels had been coated. Each coating of topcoat was approximately 25 microns in thickness and was air dried prior to application of any further coating.

L,a,b measurements were conducted on all panels. The panels were also inspected visually for colour match to a standard. In each series, the panels with a colour match to a standard panel coated with the same topcoat were determined. It was found that undercoats #5 and #7 required at least 6 coats of the topcoat before a colour match was obtained, with the grey shade being apparent after 4 coats with both of these undercoats. However, undercoat #6 gave a good colour match after 4 coats of topcoat, confirming the prediction that undercoat #6 would be the preferred undercoat.

Example II

The procedure of Example I was repeated using 35 topcoats of different colours. In each instance, the undercoat having the closest match of reflectance to that of the topcoat was the preferred undercoat, requiring the least number of coats of topcoat to obtain a colour match.

What is claimed is:

1. A process for the sequential coating of an object with at least one undercoat and then at least one pigmented topcoat, in which the at least one pigmented topcoat has a reflectance value of "R", said at least one undercoat and at least one pigmented topcoat being comprised of polymers in carrier liquids, comprising the steps of:

(a) mixing at least two compositions together to form an undercoat composition, each of said at least two compositions being comprised of polymers in carrier liquids and having different reflectance values, each of said at least two compositions having a colour selected from the group consisting of white, grey and black;

(b) controlling the blending of the at least two compositions under (a) by selecting the colour and amounts of each of the at least two compositions so that the undercoat composition has a reflectance value within $\pm$10 units of the reflectance value, "R", of the at least one pigmented topcoat; and

(c) applying the undercoat composition of (b) to the object followed by the at least one pigmented topcoat.

2. The process of Claim 1 in which the undercoat composition has a reflectance value within $\pm$5 units of the reflectance value of the at least one topcoat.

3. The process of Claim 1 or Claim 2 in which the at least two compositions used to form the undercoat composition are different shades of grey.

4. The process of Claim 1 or Claim 2 in which the at least two compositions used to form the undercoat composition are formed by admixing a black composition with a white composition.

5. The process of Claim 1 or Claim 2 in which the at least two compositions used to form the undercoat composition are formed by admixing a translucent sealer with white, grey and/or black tint compositions.