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" AN IMPROVED PROCESS FOR THE ELECTRODEPOSITION OF POLYMER COATINGS ON METAL SUBSTRATES "

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH,
Rafi Marg, New Delhi - 110 001, India an Indian registered Body incorporated under the Registeration of Societies Act (Act XXI of 1860)

The following specification describes the nature of this invention.

PRICE: TWO RUPEES

This is an invention by Dr. Sankaran Guruswamy, Scientist, Shri Pokkyarath Jayakrishnan, Senior Scientific Assistant, Shri Venkataraman Yegnaraman, Junior Scientific Assistant, Shri Nellayappan Shanmugam, Senior Laboratory Assistant, and Shri Ramasamy Rajagopal, Senior Laboratory Assistant, Central Electrochemical Research Institute, Karaikudi-6, India, all Indian citizens.

This invention relates to producing satisfactory electrocoatings on metals from aqueous systems of modified castor alkyd resin. The main object of this invention is to prepare modified castor alkyd resin suitable for water solubilisation and subsequent deposition over metals from its aqueous bath by the passage of electric current (A.C. or D.C.) so that bath with better stability and coating with improved flexibility could be obtained.

To these ends, the invention broadly consists in (a) preparing the water soluble modified castor alkyd resin (b) formulating the bath suitable for electrodeposition from the above resin (c) depositing the resin over metal articles from the above bath under standardised electrical conditions (d) baking the deposit at definite temperature for getting the required finish.

Thus in accordance with the above invention the water soluble resin is prepared by modifying castor oil with rosin and glycerol and then reacting maleic anhydride and phthalic anhydride with the above homogeneous mass in presence of propylene glycol and dibutyl phthalate.

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The reson systems described in the earlier patents (Indian Patent Nos. 129510, 132089, 130472, 137344 and 138105) dealing with the subject of electrocoating of resins were having the disadvantages of shorter bath life (less than 100 hrs.) and less flexibility for the deposited film (about 5% elongation). These two properties are improved in the case of the system presently described.

The following are the typical examples to illustrate the invention.

Example-I

1000 parts of castor oil is heated at 260°-280°C for 30 minutes and the hot oil is reacted with 600 parts of rosin and 120 parts of glycerol at 260-280°C for 30 min. The above adduct is allowed to cool and then heated with 200 parts of maleic anhydride and 340 parts of phthalic anhydride in presence of 300 parts of propylene glycol and 100 parts of dibutyl phthalate in the temperature range of 180-200°C for 6 to 8 hours.

10 parts of the resin obtained as above are solubilised with 1.2 to 1.4 parts of triethanol amine and made upto 100 parts with water and the pH of the bath is adjusted to be in the range of 7.5 - 8.0. Using this bath, electrodeposits on mild steel and aluminium articles can be obtained by making these articles as the anode and using a mild steel/aluminium plate of nearly equal area as the cathode. D.C. voltage in the range of 40-60 V is employed for a duration of 1-2 minutes. The deposits are rinsed with water and then baked at 120-200°C for 15 to 120 minutes. The baked coating is adherent, uniform, smooth and glossy. The deposit passes conical mandrel test (ASTM Specification D-522) and the film has 20 to 25% olongation. The bath is stable for more than 500 hrs.

Example-II

The bath as described in Example I is blended suitably with iron oxide pigment in the 'pigment-binder ratio'

of 1:3. This pigmented bath on electrodeposition at 40-50 V (DC) gives adherent smooth uniform brick red coloured, coating on mild steel and aluminium articles.

Example-III

Organic pigments such as colour-chem orahge, blue or red are blended suitably with the bath described in Example-I in the pigment binder ratio of 1:5. This bath on electrodeposition at 40-50 V (DC) yields satisfactory deposits having respective shades curable at 120°C within two hours.

Example-IV

Alternating current in the place of direct current can be made use of form electrodepositon in all the above three examples. In such cases the voltage applied should be in the range of 100-220 Volts with aluminium wire as the other electrode.

The main advantages of this invention are as follows:

1. The resin described in this patent is capable of giving electrocoatings suitable to the industrial requirements.
2. The aqueous bath formulated from this resin possesses better stability than those described in our earlier patents.
3. The electrocoatings obtained from this resin have got improved flexibility when compared to those described in our earlier patents.

Dated this 12th day of October, 1978.

Sd/-

(I.M.S.MAMAK)
SCIENTIST (PATENTS)
COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

150274

THE PATENTS ACT. 1970

COMPLETE SPECIFICATION

(Section—10)

"AN IMPROVED PROCESS FOR THE ELECTRODEPOSITION OF POLYMER COATINGS ON METAL SUBSTRATES":

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH,
Rafi Marg, New Delhi-110 001, India an Indian
Registered body incorporated under the Registeration
of Societies Act (Act XXI of 1860).

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed :—

This is an invention by Dr. Sankaran Guruswamy, Shri Pokkyarath Jayakrishnan, Scientists, Shri Venkataraman Yegnaraman, Junior Scientific Assistant, Shri Nellayappan Shanmugam, Junior Technical Assistant, Shri Ramasamy Rajagopal, Senior Laboratory Assistant, Central Electrochemical Research Institute, Karaikudi-6, all Indain citizens.

This invention relates to an improved process for the electrodeposition of polymer coatings on metal substrates. Such coatings are of very high industrial value for imparting corrosion resistance and insulation to metals and also for decoration purposes.

It has hitherto been known to prepare adherent polymer coatings on metals by electrodeposition from aqueous systems of linseed oil-maleic anhydride resins, shellac, castor oil-maleic anhydride resins, Rosin modified dehydrated castor oil maleic anhydride resins and a combination of alkyd-amino-epoxy resins as described in out prior Indian Patent Nos. 129510, 130472, 132089, 137344 and 138015.

The resin systems described therein is having the disadvantage of shorter bath life and the deposited coating has less flexibility.

The object of the present invention is to develop a resin system which will be free from the above drawbacks.

The other objectives are to obtain:

1) Good quality electrocoatings suitable to the industrial needs can be obtained from the resin system of this invention.
2) The aqueous bath formulated from the resin for electrodeposition described herein possesses better stability than those known in the prior act.
3) The electrocoatings obtained from this resin have got improved flexibility when compared to those

described in out prior art.

Furthermore the process is useful for obtaining electrocoatings on mild steel and aluminium articles. The aqueous resin bath has get good stability and deposite taken from the aqueous bath has improved flexibility. Moreover pigments can be dispersed in the aqueous bath and electrodeposition carried out. Alternating current also can be used for electrodeposition.

It has also been found that (i) by using modified castor alkyd resin described herein, when dispersed in water gives a bath having better stability than the resins so far developed for electrodeposition purposes,
(ii) electrodeposits obtained using the above mentioned bath possess improved flexibility after baking;
(iii) the electrodeposited film obtained by this method after baking passes the scratch hardness test tested as per IS specification 101 (1964);
(iv) iron oxide pigment can be co-deposited along with the resins after dispersing the same in the bath to produce brick-red coloured coatings on mild steel and aluminium articles;
(v) organic pigments such as 'colour-chem' orange, blue or red after dispersing in the bath can be co-deposited along with the resin to produce film deposits having respective colours, and furthermore
(vi) alternating current can also be employed for getting satisfactory electrodeposits.

The main results that could be achieved from the studies described herein are that:

(i) the electrocoating bath prepared from the resin described herein is are stable for more than 500 hours; and that (ii) the flexibility of the electrodeposits obtained from this resin bath was satisfactory upto the baking temperature of 180°C.

According to this invention an improved process for

the electrodeposition of polymer coatings on metal substrates comprising electrodepositing the coating on the said substrate using an aqueous electrolytic bath of modified castor alkyd resin and triethanolamine wherein the resin used is prepared by heating castor oil with rosin and glycerol, cooling the adduct formed and further heating the same with a mixture of maleic anhyride, phthalic anhydride, propylene glycol and dibutylphthalate in combination.

The invention further describes that the resin used is prepared by heating castor oil with rosin and glycerol at 260° to 280°C, cooling the adduct formed and further heating the same with a mixture of maleic anhydride, phthalic anhydride, propylene glycol and dibutylphthalate at 180°to 200°C in combination.

Furthermore, according to feature of the invention, the aqueous bath used consists of 10 parts of the resin, 1.2 to 1.4 parts of triethanolamine and is made upto 100 parts by water and that the pH of the bath is adjusted in the range of 7.5 to 8.0.

In order to obtain colour coatings on the substrates, there may be added to the bath a desired known pigment in combination with the binder in the pigment-binder ratio of 1:5.

Example-1

1000 parts by weight of castor oil is heated at 260°-280°C for 30 minutes and the bot oil is reacted with 600 parts of rosin and 120 parts of glycerol at 260-280°C for 30 minutes. The above adduct is allowed to cool and then 200 parts of maleic anhydride and 340 parts of phthalic anhydride are added along with 300 parts of propylene glycol and 100 parts of dibutyl phthalate and heated to 180-200°C for 6-8 hours.

10 parts of the resin obtained as above are solubilised with 1.2 to 1.4 parts of triethanol amine and made up to 100 parts with water and the pH of the bath is adjusted to be

out from this bath over mild steel and aluminium articles by making these as anodes and mild steel or aluminium plates of almost equal area as the cathode. D.C. voltage in the range 40-50V is applied for a duration of 2 minutes. The deposits are baked at 120-200°C for 15 to 120 minutes. The baked coating is adherent, uniform, smooth and glossy.

Example-II

The stability of the bath described in Example I was studied by keeping the bath for days together and taking deposits at intervals and it was found that the same was stable for more than 500 hours without affecting the quality of the deposit taken from the same.

Example-III

Electrodeposits from the bath described in Example I are baked at different temperatures ranging from 120-200°C and the flexibility of the deposit was found to be satisfactory upto the baking temperature of 180°C as shown by the conical mandrel test (ASTM specification D-522) and the film has 20 to 25% elongation.

Example-IV

To the bath described in Example I is added red oxide pigment in the pigment binder ratio of 1 : 3. Electrodeposits were taken from this pigmented bath at 50 V (DC) on mild steel and aluminium articles. These deposits are found to be smooth, adherent and brick red-coloured.

Example-V

The bath asdescribed in Example I is mixed with organic pigments such as 'colour-chem organic', 'colour-chem blue' or 'colour-chem-red' in the pigment binder ratio of 1:5. The pigmented bath thus obtained is used for electrodeposition at 50 V (DC) on mild steel and aluminium and produced satisfactory deposits having respective shades. The baking was carried out at 150°C for about two hours.

Example-VI

Deposition can be carried out from the baths described

in the above examples (I to V) using alternating current instead of direct current. The AC voltage applied for getting satisfactory deposits is 100-220 volts with aluminium wire as the other electrode.

We Claim :

1. An improved process for the electrodeposition of polymer coatings on metal substrates comprising electrodepositing the coating on the said substrate using an aqueous electrolytic bath of modified castor alkyd resin and triethanol amine wherein the resin used is prepared by heating castor oil with rosin nd glycerol, cooling the adduct formed and further heating the same with a mixture of maleic anhydride, phthalaic anhydride, propylene glycol and dibutylphthalate in combination.

2. Process as claimed in chim 1 wherein the resin used is prepared by heating castor oil with rosin and glycerol at 260-280°C, cooling the adduct formed and further heating the same with a mixture of maleic anhydride, phthalic anhydride, propylene glycol and dibutylphthalate at 180° to 200°C.

3. Process as claimed in claim 1 wherein the aqueous bath consists of 10 parts of the resin, 1.2 to 1.4 parts of triethanol amine and is made upto 100 parts by weight of water and the pH of the bath is adjusted in the range of 7.5 to 8.0.

4. Process as claimed in claims 1,2 and 3 wherein there may be added to the bath a desired known pigment in combination with a binder in the pigment-binder ratio of 1:5.

5. An improved process for the electrodeposition of polymer coatings on metal substrates substantially as herein described and illustrated with reference to the examples.

Dated this 29th day of October, 1979.

Sd/-

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