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PROVISIONAL SPECIFICATION.

IMPROVEMENTS IN OR RELATING TO PROCESS FOR PAINTING COATING OF RUSTED STEEL STRUCTURES.
 COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, RAJ MARG, NEW DELHI-1, INDIA, AN INDIAN
 REGISTERED BODY INCORPORATED UNDER THE REGISTRATION OF SOCIETIES ACT (ACT XXI OF 1860).

The following specification describes the nature of this invention.

This is an invention by SUBBIAH GURUBIAH, Scientist, MEYYAPPA SUNDARAM, Scientist, CHAK
 RAVARTHY RAJAGOPAL, Senior Scientific Assistant, KUMMATTITHIDAL SANTHANAM RAJAGOPA-
 LAN, Scientist, all of the Central Electrochemical Research Institute, Karaikudi, Tamil Nadu, India, all
 Indian citizens.

Hitherto the following methods of surface prepara-
 tion before painting of erected steel structures have
 been recommended:

- (a) complete removal of rust by sand|grit|shot
 blasting or pickling;
- (b) complete removal of rust by sand|grit|shot
 blasting or pickling and phosphating;
- (c) removal of loose rust and application of rust
 converter.

(a) and (b) are open to the objection that com-
 plete removal as mentioned above is a very costly
 procedure. The most of the rust converter composi-
 tions reported in the literature act very slowly and
 actual conversion is claimed to take 9 months to a
 year. Other rust converter compositions which act
 quickly are based on the use of special quality of
 tannic acid or other organic substances which can
 form metallo-organic compounds, making these proce-
 dures also as costly as (a).

The object of this invention is to obviate the dis-
 advantage of costly surface preparation before paint-
 ing by developing a rust converter which can be
 applied on hand cleaned steel surface, which will
 convert the adherent rust into a protective coating
 and the coating thus formed serves as a satisfactory
 base for painting.

To these ends the invention broadly consists in
 mixing a heavy metal carbonate (0.1-0.2 M) e.g.,
 manganese carbonate, lead carbonate, nickel carbonate,
 cobalt carbonate, aliphatic monocarboxylic acid (1-3
 C atoms) e.g., formic acid, acetic acid, propionic acid
 (5-10 ml.), metal powder e.g., iron, zinc, lead and alu-
 minium powder (7-12 gms.), with a solution of phos-
 phoric acid in the concentration range 15-50%. The
 concentration ranges of these substances are indicated
 in the example.

Example I

45 ml. of water is taken in a beaker to which 27
 ml. of phosphoric acid is added and stirred. Then

1.8 gm. of manganese carbonate is added and stirred
 till it is dissolved. 9 ml. of acetic acid is added.
 Finally 9 gm. of iron powder of —300 mesh is added
 and stirred well to get the rust converting composi-
 tion. This is applied on the hand cleaned mild steel
 surface with fibre brush and examined after 30
 minutes. A black adherent coating is obtained at the
 end of 30 minutes.

Example II

4 gm. of manganese acetate is added in the place
 of acetic acid and manganese carbonate, while the
 other constituents remain the same as that of Exam-
 ple I.

Example III

15.5 gm. of lead carbonate and 51 ml. of acetic acid
 are added in the place of manganese acetate while
 the other constituents remain the same as in Exam-
 ple I.

Rusted mild steel panels are coated with these
 above formulations (e.g., I, II and III). Results of
 evaluation of these coated steel panels in comparison
 with hand cleaned mild steel coated with commercial
 sample in accelerated tests and field exposure trials
 are given in Table 1.

Adhesion of conversion film as well as paint over
 converted surface tested by stripping cello tape appli-
 ed to the surface with 1 kgm., weight. The coating
 was not stripped.

Results of evaluation by immersion and salt spray
 tests of these converted steel panels painted with pri-
 mer alone as well as primer and finishing paints are
 given in Tables 2 and 3.

The important properties of the coating such as
 drying time, adhesion and coverage of these formula-
 tions are compared with commercial sample in Table
 4.

TABLE 1
 EVALUATION OF THE TREATED PLATES IN ACCELERATED TESTS AND EXPOSURE TESTS

Rust converter composition	D.W. Immersion—25 days	Exposed to atmosphere for 30 days	Exposed to salt spray 25 days
1. Example I	No change	No change	No change
2. Example II	"	"	"
3. Example III	"	"	"
4. Commercial	Coating discoloured and rust area visible	Coating brittle within 2 days	Rusted completely

TABLE 2
 EVALUATION OF TREATED PRIMER COATED PLATES IN ACCELERATED TESTS
 Period 25 days

Composition	Immersion Tests		
	D.W.	3% NaCl	Salt spray in 3% NaCl
1. Examples I, II and III	No change. No blisters	Few rust spots	No change
2. Commercial	Blisters all	Rusted completely with brown colour	Few rust spot
3. Pickled	Few rust spots	Rusted	Rust all over
4. Rusted	Rust spot all over	Heavily rusted	Paint flakes with rust

Price: TWO RUPEES.

TABLE 3

EVALUATION OF TREATED AND PRIMER AND FINISHING PAINT COATED PANELS IN ACCELERATED TESTS

Time—25 days

Composition	Immersion tests		Salt Spray in 3% NaCl
	D.W.	3%NaCl	
1. Examples I, II and III	Not affected	No change	No change
2. Commercial	Blisters all over and paint flakes	Few rust blisters	Few rust spots
3. Pickled	Few fine blisters	Few rust spots	Rust all over
4. Rusted	Few rust spots	Rust all over	Rust all over

TABLE 4

PROPERTIES OF THE RUST CONVERSION COATING

Composition	Nature of coating	Adhesion	Coverage	Time for drying
1. Examples I and II	Black	Adherent	80—90 ft ² per litre	20—30 minutes
2. Example III	Black	Adherent	80—90 ft ² per litre	20—30 minutes
3. Commercial	Black	Not adherent	50—90ft ² per litre	10—15 minutes

Advantages

1. Complete removal of the rust is not required for painting.
2. Corrosion protection after surface conversion mentioned above and painted is equal to pickled and painted.
3. The treatment gives temporary protection till the application of primer.
4. All the ingredients are indigenous.

5. This method of surface preparation is cheaper than the complete removal of rust or complete removal of rust and phosphating.

A. KUMMAR

Asstt. Patents Officer,

COUNCIL OF SCIENTIFIC AND INDUSTRIAL

RESEARCH.

Dated this 20th day of September 1974.

COMPLETE SPECIFICATION.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, RAFT MARG, NEW DELHI-1, INDIA, AN INDIAN REGISTERED BODY INCORPORATED UNDER THE REGISTRATION 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 SUBBLIAH NADAR GURUBLIAH, Scientist, MEYYAPPA SUNDARAM, Scientist, CHAKRAVARTHY RAJAGOPAL, Senior Scientific Assistant, KUMMATTTTHIDAL SANTHANAM RAJA-GOPALAN, Scientist, all from Central Electrochemical Research Institute, Karaikudi, Tamil Nadu, India, all Indian citizens.

This invention relates to improvement in or relating to process for painting of rusted steel structures.

Hitherto the following methods of surface preparation before painting of erected steel structures have been recommended:

(a) complete removal of rust by sand|grit|shot|blasting or pickling or by rust and scale removing jelly,

(b) complete removal of rust by sand|grit|shot|blasting or pickling and phosphating,

(c) removal of loose rust and application of rust converter.

(a) and (b) above are open to the objection that complete removal is a very costly procedure. Most of the rust converter compositions reported in the literature act very slowly and actual conversion is claimed to take 9 months to one year. Other rust converter compositions which act quickly are based on the use of special quality of tannic acid or other organic substances which can form metallo-organic compounds making this procedure also as costly.

The object of this invention is to be obviate the disadvantages of the costly surface preparation of rusted steel surfaces before applying a paint coating thereon.

The invented process can be used in respect of rusted steel structure which have only been hand cleaned, whereby the adherent rust is converted into a protective coating which serves as a base for applying the desired paint.

The invention, accordingly relates to an improved process for painting/coating a rusted steel structure which comprises hand cleaning the rusted steel surface, and applying thereto a basic coating composition containing dissolved in water, heavy metal carbonates, aliphatic non-catalytic acids, a metal powder and phosphoric acid, drying the same and painting the thus treated steel surface with a desired paint or coating material.

The heavy metal carbonates used in the process may be magnesium, lead or nickel carbonates.

The aliphatic non-catalytic acid used may be an aliphatic amino-carboxylic acid (1-8 carbon atoms). Such as formic, acetic or propionic acid and iron, zinc, lead, aluminium or manganese powder may be used as the metal powder of — 300 mesh in size. The phosphoric acid used may be in a concentration range of 47-50% by volume.

A typical base coating composition for use in the process of the invention may comprise 40-45% water, 25-30% of phosphoric acid, 8-10% of acetic acid, 2-3% of the metal carbonate and 8-10% of the metal powder. The admixture may be stirred to get a brushable composition. This composition when used as stated above in the process for painting of rusted steel structures chemically reacts and converts the rust into a stable protective coating which makes the steel structure suitable for painting without removing the adherent rust therefrom.

The process is very much suitable for directly painting the erected and fabricated steel structures which may have rusted to normal environmental

conditions, without going through the costly operation removing the rust from the surface thereof.

The invention broadly consists in incorporation of suitable heavy metal carbonate (2-3%) like manganese carbonate, lead carbonate, nickel carbonate, aliphatic mono-carboxylic acid (1-8 carbon atom) such as formic acid, acetic acid, propionic acid (8-10%), metal powder e.g., iron, zinc, lead and aluminium, manganese powder (8-10%) 300 mesh with a solution of phosphoric acid (85%) in concentration range 47-50%. The concentration ranges of these substances are indicated in Examples (I-III). The product has unique properties not associated with the individual ingredients, and not a mere admixture resulting in the aggregation of the properties of the components of composition.

Thus the invention consists of the use of suitable ingredients which will react and convert the rust into a stable, adherent coating which can be painted directly. The performance of this coating with an without finishing paint was evaluated by accelerated tests and field tests. The protection obtained is better than the pickled and painted plates.

A few Examples of the base coating composition for use in the process of the invention are given for the purpose of illustration and utility.

Example I

35 gm. of water is taken in a beaker to which 47 gm. of phosphoric acid (85%) is added and stirred. Then 3 gm. of manganese carbonate is added and stirred till it is dissolved. 8 gm. of acetic acid is added. Finally 8 gm. of iron powder of 300 mesh is added and stirred well to get the rust converting composition. This is applied on the hand cleaned mild steel surface with fibre brush and examined after 30 minutes. A black adherent coating is obtained at the end of 30 minutes.

Example II

3 gm. of manganese acetate is added in the place of acetic acid and manganese carbonate, while the other constituents remain the same as that of Example I.

Example III

15.5 gm. of lead carbonate and 9 gm. of acetic acid are added in the place of manganese acetate while the other constituents remain the same as in Example I.

Hand cleaned mild steel panels are coated with these above formulations (e.g., I, II and III). Results of these coated steel panels, in comparison with hand cleaned mild steel coated with commercial sample, in accelerated tests and field exposure trials are given in Table 1.

Adhesion of converted film as well as paint over converted surface is tested by stripping "Cellotape" applied to the 2 square cm. surface with 1 kgm. weight. The adhesion is better than the commercial treatment plate.

Results of evaluation by immersion and salt spray tests of these converted steel panels painted with primer alone as well as primer and finishing paints are given in Tables 2 and 3.

The important properties of the coating such as drying time, adhesion and coverage of these formulations are compared with commercial sample in Table 4. The observation of painted panels exposed to marine atmosphere at Mandapam Camp is given in Table 5. The following marks were awarded for the property of paint film, checking, chalking, cracking and flaking, each 10 marks—total 40, then blistering 25 marks, rusting 25, spread of rust at scratch 10 marks. Thus a total of 100 marks was allotted. Photographic standards from ASTM was used for evaluation.

TABLE 1
EVALUATION OF THE TREATED PLATES IN ACCELERATED TESTS AND EXPOSURE TESTS

Rust converter composition	Distilled Water Immersion 25 days	Exposed to atmosphere for 30 days	Exposed to salt spray 25 days
1. Example I	No change	No change	No change
2. Example II	"	"	"
3. Example III	"	"	"
4. Commercial	Coating discoloured and rust area visible	Coating brittle within 2 days	Rusted completely

TABLE 2
EVALUATION OF TREATED & PRIMER COATED PLATES IN ACCELERATED TESTS
Period—25 days

Mode of treatment	Immersion Tests		
	Distilled Water	3% NaCl	Salt Spray in 3% NaCl
1. Examples I, II and III	No change	Few rust spots	No change
2. Commercial	Blisters all over	Rusted completely with brown colour	Few rust spot
3. Pickled	Few rust spots	Rusted	Rust all over
4. Hand cleaned	Rust spot all over	Heavily rusted	Paint flakes with rust

TABLE 3
EVALUATION OF TREATED & PRIMER & FINISHING PAINT COATED PANELS IN ACCELERATED TESTS
Duration of test — 25 days

Mode of treatment	Immersion tests		
	Distilled water	3% NaCl	Salt Spray in 3% NaCl
1. Examples I, II and III	Not affected.	No change	No change
2. Commercial	Blisters all over and paint flakes.	Few rust blisters.	Few rust spots.
3. Pickled	Few fine blisters.	Few rust spots.	Rust all over.
4. Hand cleaned	Few rust spots.	Rust all over.	Rust all over.

TABLE 4
PROPERTIES OF THE RUST CONVERSION COATING

Composition	Nature of coating	Adhesion	Coverage	Time for drying.
1. Example I & II	Black	Adherent	80-90 ft ² per litre	20-30 minutes.
2. Example III	Black	Adherent	80-90 ft ² per litre	20-30 minutes.
3. Commercial	Black	Not adherent	50-60 ft ² per litre	10-15 minutes.

TABLE 5
OBSERVATIONS AT THE END OF 10 MONTHS AT MANDAPAM CAMP.

Particulars	M.S. Angles Merit value for 100	6" x 4" M.S. plates Merit value for 100
1. Rusted and R.O./ZnCrO ₄	20	0
2. Rusted+P & F. P.	40	40
3. Patent composition Treated+Primer (R.O./ZnCrO ₄)	70	60
4. Patent composition Treated+P & F. P.	80	55
5. Pickled+Primer (R.O./ZnCrO ₄)	0	0
6. Pickled+R.O./ZnCrO ₄ +F.P.	40	0
7. Commercial product+R.O./ZnCrO ₄	0	0
8. Commercial R.O./ZnCrO ₄ +F.P.	40	38
P = Primer	80-100	— Excellent
FP = Finish Paint	60-80	— Very good
RO = Red oxide Zinc chromate to I. S. 2074	40-60	— Good
	20-40	— Fair
	0-20	— Bad

The results showed that the performance of the new process of coating rusted steel surfaces is better than the commercial products.

The main advantages of the invention are:

(a) Complete removal of the rust is not required for painting.

(b) The treatment gives temporary protection till the application of primer.

(c) Corrosion protection after surface preparation mentioned above and painted is better than pickled and painted.

(d) This method of surface preparation is cheaper than complete removal of rust or complete removal of rust and phosphating.

(e) All the raw-materials are available indigenously.

(f) This treatment is suitable for erected structures and can be applied by brush.

We claim:

1. An improved process for painting/coating a rusted steel structure comprises hand cleaning the rusted steel surface, applying thereto a basic coating composition containing dissolved in water, heavy metal carbonate, non-catalytic acids such as herein described, a metal powder and phosphoric acid, drying the same and painting the thus treated steel structure with a desired paint or coating material.

2. The process according to Claim 1 wherein the heavy metal carbonates used are magnesium, lead or nickel carbonates.

3. The process accordingly Claim 1 wherein the aliphatic non-catalytic acid used is an aliphatic amino-carboxylic acid (1-8 carbon atoms) such as formic, acetic or propionic acid.

4. The process as claimed in Claim 1 wherein the metal powder used is of iron, zinc, lead, aluminium or magnesium.

5. The process as claimed in Claim 2 wherein the heavy metal carbonate used is in an amount of 2-3% by volume.

6. The process according to Claim 3, wherein the aliphatic acid used is in amount of 8-10% by volume.

7. The process according to Claim 4, wherein up to 8-10% by weight of the metal powder is used and its particle size is at least of 300 mesh.

8. The process as claimed in Claim 1 wherein up to 25-30% by volume of the phosphoric acid is used.

9. An improved process for painting/coating a rusted steel structure as substantially hereinbefore described.

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Dated this 10th day of October 1975.