

25 JUL 2000

EPOXY RESIN COATING COMPOSITION

The present invention relates to an epoxy resin coating
5 composition which can be applied by spraying even under a low
temperature condition and is excellent in finishing and which can
form a coating film excellent in coating film properties and a corro-
sion resistance and has a long pot life.

An epoxy-amine base coating composition comprising an
10 epoxy resin and an amine base curing agent as principal vehicle
components has so far been known. This coating composition has a
relatively high viscosity, and therefore it is usually difficult to apply
it by spraying. On the other hand, applying by means of a brush or a
roller provides the problems that because of the poor fluidity, the
15 resulting coating film is lacking in a smoothness and inferior in a
finishing property and that if the coating material is diluted and then
applied, dropping is caused. Particularly under a low temperature
condition that an atmospheric temperature is 10°C or lower, the
viscosity is notably elevated, and the coating property and the finish-
20 ing property are markedly reduced.

On the other hand, if a reactive diluent or a non-reactive
diluent is blended in large quantities with the above coating composi-
tion to reduce a viscosity of the coating material in order to improve a
coating property and a finishing property of the coating film, a cur-
25 ability of the coating film is markedly reduced, and it becomes diffi-
cult to form the coating film having stable coating film physical
properties and corrosion resistance.

Also, the conventional epoxy-amine base coating composi-
tion described above is a two packaged type, and when the epoxy
30 resin is mixed with the amine base curing agent in using, the reac-
tion of both is accelerated by heat generation and residence of heat

caused by the reaction of both, and the curing reaction is rapidly advanced for a little period of time after mixing, so that the coating mixture is notably increased in a viscosity or solidified, or in a serious case, the mixture burns and fumes. Accordingly, the coating work
5 becomes difficult or falls in a dangerous state in terms of safety working in a certain case.

An object of the present invention is to provide an epoxy-amine base coating composition which has a low viscosity without blending a reactive diluent or a non-reactive diluent in a large
10 quantity and can be coated by spraying even under a low temperature condition and which can form a coating film having an excellent smoothness and a good finishing property as well by a coating method with a brush and a roller without placing any restrictions on coated parts.

15 In addition, an object of the present invention is to provide an epoxy-amine base coating composition capable of forming a coating film which has an excellent curability and is excellent in coating film physical properties and a corrosion resistance.

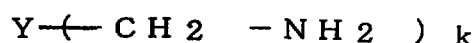
Further, an object of the present invention is to provide an
20 epoxy-amine base coating composition in which the reaction is scarcely advanced during storage of the coating material and a pot life thereof after mixing is long and in which no or a little heat is generated during coating and the viscosity does not markedly go up for short time, so that a continuous coating work can stably be carried
25 out.

Intensive investigations continued by the present inventors have resulted in finding that the objects described above can be achieved by combining a liquid epoxy resin having a low viscosity with a ketimine compound having a low viscosity obtained by block-
30 ing an amino group of an amine compound having a primary amino group bonded to a primary carbon atom with dialkyl ketone to pre-

pare a coating material, and they have come to complete the present invention.

Thus, the present invention provides a coating composition comprising as vehicle components:

- 5 (A) a liquid epoxy resin which has at least one epoxy group on an average in a molecule and which has a viscosity of 3,000 mPa·s or less at 25°C, and
- (B) a ketimine compound which is obtained by blocking an amino group of a polyamine compound represented by the following formula
- 10 with dialkyl ketone and which has a viscosity of 500 mPa·s or less at 25°C:



- wherein Y represents an organic group of k valence or a direct bond,
- 15 and k is an integer of 2 or more.

Also, the present invention provides a coating method characterized by applying the coating composition described above by spraying on a coated article without diluting with a solvent.

- Further, the present invention provides a coating method
- 20 characterized by applying the coating composition described above on a steel surface on which rust remains and curing the coating film to fix the rust.

- Still further, the present invention provides a coating method characterized by applying the coating composition described
- 25 above on a steel surface on which a coating film of an inorganic zinc-rich paint is formed.

The coating composition of the present invention and the coating methods of the present invention shall be explained below in further details.

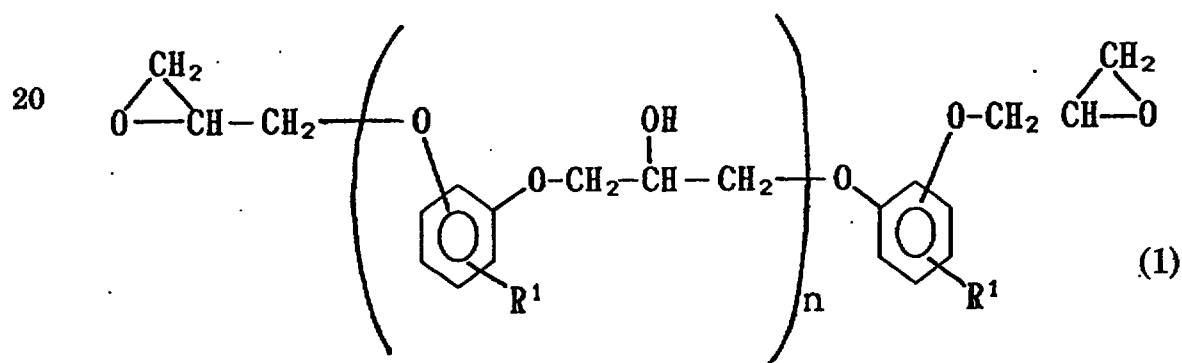
- 30 The coating composition of the present invention comprises the liquid epoxy resin (A) and the ketimine compound (B) each

described below as the vehicle components.

Liquid epoxy resin (A)

In the present invention, used as the epoxy resin component is a liquid epoxy resin which has at least one epoxy group, preferably two or more epoxy groups on an average in a molecule and which has a viscosity falling in a range of 3,000 mPa·s (millipascal second) or less, preferably 2,000 mPa·s or less and more preferably 500 to 1,500 mPa·s at 25°C.

Typical examples of such liquid epoxy resin (A) include, for example, epoxy resins such as an epoxy resin derived from alkyldiphenol and epichlorohydrin, an epoxy resin derived from alkylphenol novolak and epichlorohydrin, a bisphenol F type epoxy resin, a hydrogenated bisphenol A type epoxy resin and a hydrogenated bisphenol F type epoxy resin. Among them, the epoxy resin derived from alkyldiphenol and epichlorohydrin is suited and includes, for example, an epoxy resin comprising a compound represented by the following Formula (1) as a principal component:



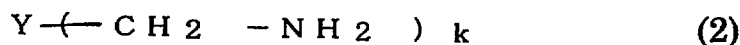
wherein R^1 represents an alkyl group having 1 to 8 carbon atoms, and n is an integer of 0 to 2, preferably 1.

The "alkyl group" represented by R^1 in the formula described above may be either linear or branched and includes, for example, methyl, ethyl, isopropyl, n-propyl, n-butyl, isobutyl, t-butyl, n-hexyl, n-octyl and 2-ethylhexyl. Among them, t-butyl is suited.

Conventionally known resins can be used as the liquid epoxy resin (A), and capable of being used are, for example, commercial products including alkylphenol type epoxy resins such as Epicon EXA-7120 and ditto EXA-6200 (trade names, both manufactured by Dainippon Ink and Chemicals, Inc.); alkylphenol novolak type epoxy resins such as Epicon EXA-6188 (trade name, manufactured by Dainippon Ink and Chemicals, Inc.); bisphenol F type epoxy resins such as Epikote 806, ditto 806L and ditto 1750 (trade names, all manufactured by Yuka Shell Epoxy Co., Ltd.); hydrogenated bisphenol A type epoxy resins such as Epikote YL6663 (trade name, manufactured by Yuka Shell Epoxy Co., Ltd.); and a hydrogenated bisphenol F type epoxy resin such as Epikote YL6753 (trade name, manufactured by Yuka Shell Epoxy Co., Ltd.).

Ketimine compound (B)

The ketimine compound (B) used in the present invention is a curing agent for the liquid epoxy resin (A) described above and is a ketimine compound which is obtained by blocking an amino group of a polyamine compound represented by the following Formula (2) with dialkyl ketone and which has a viscosity falling in a range of 500 mPa·s or less, preferably 10 to 400 mPa·s and more preferably 30 to 300 mPa·s at 25°C:



wherein Y represents an organic group of k valence or a direct bond, and k is an integer of 2 or more, preferably 2 to 4.

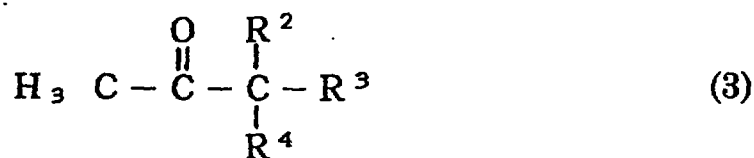
The polyamine compound represented by Formula (2) described above is a compound having two or more primary amino groups bonded to a primary carbon atom in a molecule, and the "organic group of k valence" represented by Y in the formula described above includes an aliphatic, alicyclic, aromatic or araliphatic

hydrocarbon group of k valence. The above polyamine compound has advantageously a primary amino group equivalent falling in a range of usually about 2,000 or less, preferably about 30 to about 1,000 and more preferably about 50 to about 500 and has suitably a number
5 average molecular weight falling in a range of usually about 5,000 or less, preferably about 60 to about 3,000 and more preferably about 100 to about 1,500.

Specific examples of the polyamine compound described above includes, for example, aliphatic polyamines such as ethylene-
10 diamine, propylenediamine, butylenediamine, hexamethylenediamine, diethylenetriamine, triethylenetetraamine and pentaethylenehexamine; aromatic polyamines such as metaxylylenediamine, diaminodiphenylmethane and phenylenediamine; and alicyclic polyamines such as 1,3-bis(aminomethyl)-cyclohexane and iso-
15 phoronediamine.

Among the polyamine compound described above, the polyamine compounds having substantially no secondary amino groups in a molecule, that is, having only primary amino groups capable of being blocked with a carbonyl compound as amino groups
20 having active hydrogen atoms are particularly suited because of a good storage stability thereof after mixed with the epoxy resin. When using a polyamine compound having a secondary amino group in a molecule, it is preferably used in the form of an adduct compound obtained by reacting the secondary amino group with an epoxy
25 compound to consume the secondary amino group.

In particular, a compound represented by the following Formula (3) is suited to the dialkyl ketone used for blocking the primary amino group of the polyamine compound described above from a viewpoint of balance between both curability and storage
30 stability:



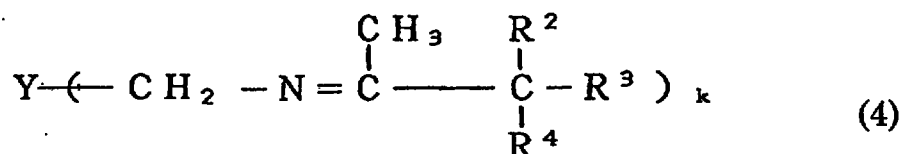
5 wherein R^2 represents an alkyl group having 1 to 6 carbon atoms, and R^3 and R^4 may be the same or different and represent a hydrogen atom, methyl or ethyl.

In Formula (3) described above, the alkyl group having 1 to 6 carbon atoms represented by R^2 may be linear or branched and, 10 to be specific, includes, for example, methyl, ethyl, n-propyl, n-butyl, isobutyl and n-hexyl. Among them, the alkyls group having 1 to 3 carbon atoms are suited.

Thus, the dialkyl ketone represented by Formula (3) includes, for example, methyl ethyl ketone, methyl isopropyl ketone, 15 methyl isobutyl ketone, methyl t-butyl ketone, methyl sec-butyl ketone and methyl hexyl ketone. Among them, methyl isopropyl ketone is suited.

The reaction of the polyamine compound described above with the dialkyl ketone described above can be carried out according 20 to a conventionally known Schiff base-formation reaction. In this case, the reaction (dehydration reaction) is preferably carried out in such quantitative proportion and reaction condition that substantially all primary amino groups present in the polyamine compound are reacted with the dialkyl ketone.

25 The ketimine compound obtained by the reaction of the polyamine compound represented by Formula (2) described above with the ketone represented by Formula (3) described above can be represented by the following Formula (4):



- 5 wherein Y represents an organic group of k valence or a direct bond, and k is an integer of 2 or more; in a repetitive unit, respective R²'s may be the same or different and represent an alkyl group having 1 to 6 carbon atoms; respective R³'s may be the same or different and represent methyl or ethyl; and respective R⁴'s may be the same or
10 different and represent a hydrogen atom, methyl or ethyl.

In the composition of the present invention, it is preferred from a viewpoint of a curing property, a non-adhesive property and a corrosion property of the coating film that the ketimine compound (B) described above is contained in such a proportion that active hydro-
15 gen bonded to a free primary amino group formed by dissociating ketone from the ketimine compound (B) falls in a range of 0.5 to 3 equivalents, preferably 0.8 to 1.5 equivalent and more preferably 0.8 to 1.2 equivalent per equivalent of an epoxy group contained in the epoxy compound (A) described above.

20 Coating composition

The coating composition of the present invention contains the liquid epoxy resin (A) and the ketimine compound (B) each described above as the essential components and can further contain, if necessary, additives for a coating material including a reactive
25 diluent, a dehydrating agent, an organic solvent; a modifying resin component such as a modified epoxy resin having no epoxy group, a xylene resin, a toluene resin, a ketone resin, a coumarone resin, a petroleum resin, an alkyd resin, boiled oil and stand oil; metal powder such as zinc powder and aluminum powder; pigments such as a
30 color pigment, an extender pigment and a rust preventive pigment; a thickener, a plasticizer, a filler and a dispersant.

The reactive diluent contained, if necessary, in the composition of the present invention includes, for example, compounds of a low viscosity having one epoxy group in a molecule. Typical examples of the reactive diluent include, for example, glycidyl ethers
5 having one glycidyl group in a molecule such as n-butyl glycidyl ether, allyl glycidyl ether, 2-ethylhexyl glycidyl ether and phenyl glycidyl ether; glycidyl esters having one glycidyl group in a molecule such as glycidyl methacrylate; and styrene oxide.

Commercial products of the reactive diluent include, for
10 example, Cardura E (trade name, glycidyl ester of higher branched fatty acid, manufactured by Shell Chemicals Co., Ltd.), Epiclon 703 (trade name, glycidyl ether of higher alcohol, manufactured by Dainippon Ink and Chemicals, Inc.) and Epiclon 520 (trade name, glycidyl ether of butylated phenol, manufactured by Dainippon Ink
15 and Chemicals, Inc.).

The use amount of the reactive diluent falls suitably in a range of 30 % by weight or less, preferably 20 % by weight or less based on the weight of the solid matter of the coating composition from a viewpoint of a curing property, physical properties, a corrosion
20 resistance and a water resistance of the coating film.

Conventionally known dehydrating agents can be used for the dehydrating agent contained, if necessary, in the composition of the present invention, and representative examples thereof include, for example, methyl orthoformate, ethyl orthoformate and dimeth-
25 oxypropane. These dehydrating agents can be used alone or in combination of two or more kinds thereof. The use amount thereof shall not specifically be restricted and falls suitably in a range of usually 15 % by weight or less, preferably 0.5 to 10 % by weight based on the weight of the coating composition.

30 The coating composition of the present invention may be a solventless type coating material containing no solvent but can

contain, if necessary, an organic solvent for the purpose to improve a coating property. Any solvents can be used for the organic solvent without specific restrictions as long as they can dissolve or disperse the liquid epoxy resin (A) and the ketimine compound (B). An amino
5 group can be inhibited from being formed by decomposition of the ketimine compound during storage of the coating material by adding a ketone solvent as a part of the organic solvent, and it is advantageous in the case of a single liquid type coating material. The amount of the organic solvent contained in the coating material is
10 suitably an amount of usually 30 % by weight or less, particularly 20 % by weight or less from a viewpoint of a curing property.

The coating composition of the present invention has a viscosity falling suitably in a range of 5,000 mPa·s or less, preferably 5 to 3,000 mPa·s and more preferably 10 to 500 mPa·s, and a coating
15 material form may be either a single packaged type or a two packaged type. Also, the coating composition of the present invention can considerably be reduced in a viscosity as well when it does not contain the organic solvent and therefore can be applied on a coated article by spraying without diluting with a solvent.

20 Coating

The composition of the present invention can be applied on material surfaces of metals (iron, aluminum, zinc and the like), wood, plastics, stones, slates, concrete and mortar or old coating film surfaces applied on these materials, steel surfaces on which rust re-
25 mains and steel surfaces on which coating films of an inorganic zinc-rich paint are formed. A coating method shall not specifically be restricted, and conventional methods such as, for example, brush coating, spray coating and various coater coating can be used.

The composition of the present invention can display the
30 excellent effects that when applied on a steel surface on which rust remains, it penetrates sufficiently into the rust because of a low

viscosity thereof and is cured to thereby fix the rust and reinforce the mechanical strength thereof and that it adheres strongly and stably onto the steel base surface beneath the rust to form a strong coating film together with the rust.

5 Further, the composition of the present invention can display the effect that when applied on a steel surface on which a coating film of an inorganic zinc-rich paint is formed, it can penetrate sufficiently into the coating film of the inorganic zinc-rich paint to fill up a lot of voids present in the coating film of the inorganic zinc-rich
10 paint, so that defects such as bubbles and pin holes on the coating film caused by air contained in the voids are prevented from being brought about.

 The coating amount of the composition of the present invention shall not specifically be restricted and can be changed
15 according to the coating purposes. In general, it falls suitably in a range of about 10 to about 150 μm , preferably about 10 to about 100 μm in terms of a cured film thickness in the case of a clear coating material and in a range of about 10 to about 500 μm , preferably about 25 to about 300 μm in terms of a cured film thickness in the
20 case of an enamel coating material containing a pigment.

 Further, a top coating material can be applied, if necessary, on a coating film formed by applying and curing the composition of the present invention. This top coating material shall not specifically be restricted, and conventionally known top coating
25 materials can be used. Capable of being used are, for example, coating materials of an alkyd resin base, a chlorinated rubber base, an epoxy resin base, a silicon alkyd resin base, a urethane resin base, a silicon acryl resin base and a fluororesin base.

 The present invention shall more specifically be explained
30 below with reference to examples and comparative examples. "Parts" and "%" in the examples show "parts by weight" and "% by weight"

unless otherwise described.

Example 1

Charged in order and mixed were 100 parts of "Epiclon EXA-7120" (remark 1), 50 parts of titanium dioxide, 75 parts of
5 magnesium silicate and 8 parts of xylene, and the mixture was subjected to pigment dispersion by means of a sand mill until the dispersibility (JIS K5400 4. 7. 1) became 60 μm to obtain a dispersion base. Then, 25 parts of a curing agent A shown in the following Table 1 was added to this dispersion bases and mixed to obtain a
10 coating composition.

(Remark 1) "Epiclon EXA-7120": manufactured by Dainippon Ink and Chemicals, Inc., an alkyldiphenol type liquid epoxy resin having a viscosity of 1,600 $\text{mPa}\cdot\text{s}$ (25°C) and a structure in which either of two R^1 's in Formula (1) described above is
15 t-butyl.

Table 1

Kind of curing agent	Polyamine compound	Kind of ketone	Conversion to ketimine	Viscosity (25°C) mPa·s
Curing agent A	1,3-Aminomethylcyclohexane	Methyl isopropyl ketone	Present	500
Curing agent B	1,3-Aminomethylcyclohexane	Methyl isobutyl ketone	Present	500
Curing agent C	Metaxylylenediamine	Methyl isopropyl ketone	Present	500
Curing agent D	Metaxylylenediamine	Methyl isobutyl ketone	Present	500
Curing agent E	Adduct of metaxylylenediamine and Epikote 828 (remark 2)	Methyl isopropyl ketone	Present	4500
Curing agent F	Metaxylylenediamine	—	None	500

The remark in Table 1 means the following.

(Remark 2) Epikote 828: manufactured by Yuka Shell Epoxy Co., Ltd., a bisphenol A type liquid epoxy resin having a viscosity of 13,500 mPa·s (25°C)

5 Examples 2 to 7 and Comparative Examples 1 to 3

The same procedure as in Example 1 was repeated to obtain the respective coating compositions, except that the blending compositions were set as shown in the following Table 2 in Example 1. The properties of the respective coating compositions are shown in
10 Table 2.

The remarks in Table 2 mean the following.

(Remark 3) Epiclon EXA-6200: manufactured by Dainippon Ink and Chemicals, Inc., an alkyldiphenol type liquid epoxy resin having a viscosity of 630 mPa·s (25°C).

15 (Remark 4) Epiclon EXA-6188: manufactured by Dainippon Ink and Chemicals, Inc., an alkylphenol novolak type liquid epoxy resin having a viscosity of 1,800 mPa·s (25°C).

Table 2

		Example							Comparative Example		
		1	2	3	4	5	6	7	1	2	3
(A)	Epiclone EXA-7120	100	100	100					100		100
	Epiclone EXA-6200 (remark 3)				100	100					
	Epiclone EXA-6188 (remark 4)						100	100			
	Epikote 828									100	
Pig-ment	Titanium dioxide	50	50	50	50	50	50	50	50	50	50
	Magnesium silicate	75	75	75	75	75	75	75	75	75	75
Xylene		8	8	8	8	8	8	8	8	110	16
(B)	Curing agent A	25			23					23	
	Curing agent B		25				25				
	Curing agent C			25		23					
	Curing agent D							25			
	Curing agent E										45
	Curing agent F								24		
Equivalent ratio of (B)/(A)		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Pro-property	Solid content (%)	97	97	97	97	97	97	97	97	69	91
	Viscosity (mPa·s)	1000	1000	1000	700	700	1200	1200	1000	4500	3000

The respective coating compositions obtained in Examples 1 to 7 and Comparative Examples 1 to 3 described above were subjected to various tests based on the following test methods. The test results thereof are shown in the following Table 3.

5 Test methods

Drying property:

The coating composition was applied on a tin plate by means of a film applicator having a clearance of 200 μm and left standing in an atmosphere of a temperature of 20°C and a humidity
10 of 65 % RH to evaluate time spent until the coating film surface came up to a tack dry state by touch with a finger.

Pot life:

A curing agent was added and mixed to prepare a coating composition, and then it was placed in a room of 20°C to evaluate
15 time (time spent since the curing agent was mixed) spent until it was gelatinized.

Penetrability into rust:

(1) Filter paper penetrating method

A strip-shaped filter paper having a width of 1 cm was
20 hung and dipped in a vessel filled with the sample in a depth of 1 cm, and after one hour, it was compared with the initial state to confirm a distance (cm) in which the sample penetrated into the filter paper.

(2) Adhesive property

Used was a steel plate (shot blast plate having a thickness
25 of 3.2 mm) which was exposed in a shore area and had rust generated on the whole surface. It was subjected to tertiary surface preparation in order to remove a fragile rust layer present just on a surface thereof, and the respective coating compositions were applied on this base in a thickness of 4 mil. After aging at 20°C for 7 days, the
30 adhesion was determined by means of an adhesion tester manufactured by Elcometer Co., Ltd. In this case, peeled portions were

recorded as well. In the peeled portions, "coating film" means cohesive failure in the coating film layer; "film/rust" means interlayer peeling between the coating film and the rust; and "rust" means peeling in the rust layer.

5 Defoaming effect in coating:

The respective coating compositions which were not diluted were applied on an inorganic zinc-rich coating film having a thick film (75 μm) by means of an air spray until the inorganic zinc-rich coating film was not observed (until lack of hiding was not
10 observed), and then the coating films were aged at a room temperature (20°C) for 24 hours. Next, an epoxy resin corresponding to a secondary undercoating material provided in JIS K5551 (epoxy resin coating material) was applied thereon so that a dried film thickness became 40 μm to confirm the presence of bubbles formed on the
15 coated surface. The absence of bubbles formed was judged with ○ (good), and the presence of bubbles formed was judged with × (inferior).

Airless applicability:

The respective coating compositions which were not diluted were applied using Airless Tip 519 manufactured by Japan
20 Gray Co., Ltd. to synthetically evaluate a coating workability such as a film-forming property of the coating film and atomization and judge it with ○ (good), △ (slightly inferior) and × (inferior).

Water resistance:

25 The coating composition was applied on a cold-finished mild steel plate polished with a sand paper #240 so that a dried film thickness became 40 μm and aged at 20°C for 7 days, and then the plate was immersed in pure water of 40°C for 7 days. After pulling it up, the presence of defects such as blistering and rust on the coating
30 film was visually judged. The case of the absence of these coating film defects was judged with ○ (good).

Elongation percentage of coating film:

A strip-shaped film having a thickness of 100 μm , a width of 5 mm and a length of 20 mm was prepared, and an elongation percentage (%) of the coating film observed when the coating film was broken was determined by means of Tensilon (tensile testing machine) manufactured by Toyo Bowldwin Co., Ltd.

Du Pont system impact resistance test:

The coating composition was applied on a mild steel plate by spraying so that a dried film thickness became 100 μm and aged at 20°C for 7 days. This coated plate was subjected to a Du Pont system impact resistance test provided in JIS K5400 8. 3. 2 (1990) to examine the presence of cracking of the coating film. The test conditions were a weight load of 500 g, a falling height of 30 cm and a tip diameter of 1/2 inch of an impact needle. The case of no cracking was judged with ○ (good).

Corrosion resistance:

The coating composition was applied on a sand blast plate by spraying so that a dried film thickness became 100 μm and aged at 20°C for 7 days, and then 60 degree X-cuts having a width of 1 mm which reached the base were provided. This crosscut plate was subjected to a salt spray test for 1000 hours to evaluate the state of the coating film by one side width from the cut part of a larger one out of rust and blister in the cut part:

- : one side width is less than 1 mm
- △: one side width is 1 mm or more and less than 3 mm
- ×: one side width is 3 mm or more

Table 3

		Example							Comparative Example				
		1	2	3	4	5	6	7	1	2	3		
Test result	Drying property 20°C (hour)		4	4	4	4	4	4	4	4	4	4	
	Pot life (hour)		48	48	48	48	48	48	48	2	3	4	
	Pene- tra- bility into rust	Filter paper pene- trating method (cm)	5.0	5.0	5.0	5.5	5.5	4.5	4.5	4.0	1.0	1.5	
		Adhesive property (kg/cm ²)	45	45	45	45	45	45	45	45	18	10	12
		Peeled portion	Coating film	Coating film	Coating film	Coating film	Coating film	Coating film	Coating film	Film/ rust	Rust	Rust	
	Defoaming effect in coating		○	○	○	○	○	○	○	○	×	×	
	Airless applicability		○	○	○	○	○	○	○	○	×	×	
	Water resistance		○	○	○	○	○	○	○	○	○	○	
	Elongation percentage (%) of coating film		4	4	4	4	4	4	4	3	2	2	
	Du Pont system impact resistance test		○	○	○	○	○	○	○	○	○	○	
Corrosion resistance		○	○	○	○	○	○	○	○	○	○		

As apparent from the test results described above, the coating composition of the present invention is reduced in a viscosity without blending a large amount of a reactive diluent or a non-reactive diluent and can be applied by spraying as well under a low
5 temperature condition, and it can form a coating film which is excellent in a smoothness and has a good finishing property and which is excellent in a curability, coating film properties and a corrosion resistance.

Further, the coating composition of the present invention
10 is scarcely advanced in reaction during storage of the coating material and has a long and good pot life. No or only a little heat is generated during coating, and the viscosity is not suddenly elevated for short time, so that a continuous coating work can stably be carried out.



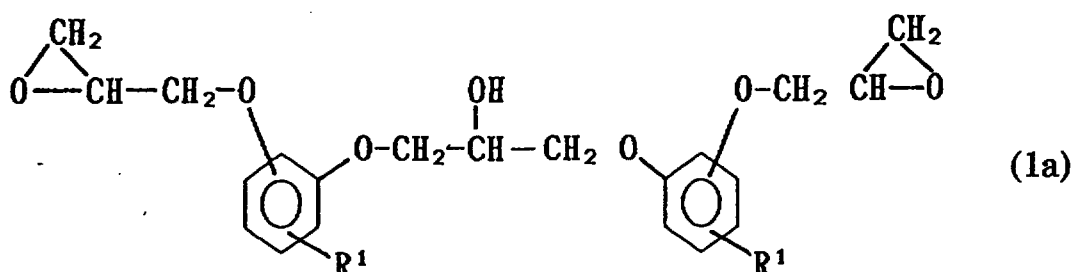
CLAIMS:

1. A coating composition comprising as vehicle components:
 - (A) a liquid epoxy resin which has at least one epoxy group on an average in a molecule and which has a viscosity of 3,000 mPa·s or less at 25°C, and
 - (B) a ketimine compound which is obtained by blocking an amino group of a polyamine compound represented by the following formula with dialkyl ketone and which has a viscosity of 500 mPa·s or less at 25°C:



wherein Y represents an organic group of k valence or a direct bond, and k is an integer of 2 or more.

2. The coating composition as described in claim 1, wherein the liquid epoxy resin (A) has a viscosity of 2,000 mPa·s or less.
3. The coating composition as described in claim 1, wherein the liquid epoxy resin (A) is an epoxy resin derived from alkyldiphenol and epichlorohydrin.
4. The coating composition as described in claim 1, wherein the liquid epoxy resin (A) comprises a compound represented by the following Formula (1a) as a principal component:



wherein R¹ represents an alkyl group having 1 to 8 carbon atoms.

5. The coating composition as described in claim 4, wherein R¹ is t-butyl.
6. The coating composition as described in claim 1, wherein

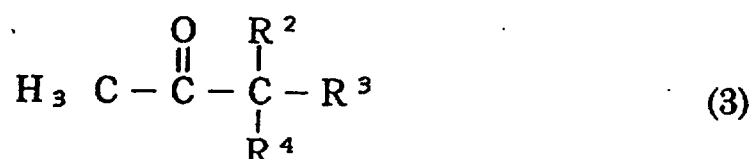


the polyamine compound has a primary amino group equivalent of 2,000 or less and a number average molecular weight of 5,000 or less.

7. The coating composition as described in claim 1, wherein the polyamine compound has a primary amino group equivalent falling in a range of 30 to 1,000 and a number average molecular weight falling in a range of 60 to 3,000.

8. The coating composition as described in claim 1, wherein the polyamine compound is selected from the group consisting of ethylenediamine, propylenediamine, butylenediamine, hexamethylenediamine, diethylenetriamine, triethylenetetraamine, pentaethylenehexamine, metaxylylenediamine, diaminodiphenylmethane, phenylenediamine, 1,3-bis(aminomethyl)cyclohexane and isophoronediamine.

9. The coating composition as described in claim 1, wherein the ketimine compound (B) is a ketimine compound obtained by blocking with dialkyl ketone represented by the following Formula (3):



wherein R^2 represents an alkyl group having 1 to 6 carbon atoms, and R^3 and R^4 may be the same or different and represent a hydrogen atom, methyl or ethyl.

10. The coating composition as described in claim 9, wherein R^2 is an alkyl group having 1 to 3 carbon atoms.

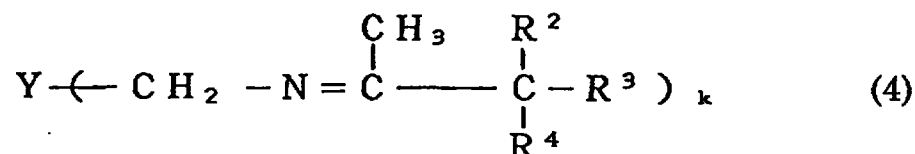
11. The coating composition as described in claim 9, wherein the dialkyl ketone is selected from the group consisting of methyl ethyl ketone, methyl isopropyl ketone, methyl isobutyl ketone, methyl t-butyl ketone, methyl sec-butyl ketone and methyl hexyl ketone.

12. The coating composition as described in claim 11, wherein



the dialkyl ketone is methyl isopropyl ketone.

13. The coating composition as described in claim 1, wherein the ketimine compound (B) is represented by the following Formula (4):



wherein Y represents an organic group of k valence or a direct bond, and k is an integer of 2 or more; in a repetitive unit, respective R²'s may be the same or different and represent an alkyl group having 1 to 6 carbon atoms; respective R³'s may be the same or different and represent methyl or ethyl; and respective R⁴'s may be the same or different and represent a hydrogen atom, methyl or ethyl.

14. The coating composition as described in claim 1, wherein the ketimine compound (B) is contained in such a proportion that active hydrogen bonded to a free primary amino group formed by dissociating ketone from the ketimine compound (B) falls in a range of 0.5 to 3 equivalents per equivalent of an epoxy group contained in the epoxy compound (A).

15. The coating composition as described in claim 1, wherein the ketimine compound (B) is contained in such a proportion that active hydrogen bonded to a free primary amino group formed by dissociating ketone from the ketimine compound (B) falls in a range of 0.8 to 1.5 equivalent per equivalent of an epoxy group contained in the epoxy compound (A).

16. The coating composition as described in claim 1, further comprising a reactive diluent.

17. The coating composition as described in claim 16, wherein the reactive diluent is a compound of a low viscosity having one epoxy group in a molecule.



18. The coating composition as described in claim 16, wherein the reactive diluent has a content of up to 30 % by weight based on the weight of the solid matter of the coating composition.
19. The coating composition as described in claim 1, being a solventless type coating material.
20. The coating composition as described in claim 1, being a single liquid type coating material.
21. A coating method characterized by applying the coating composition as described in claim 1 by spray on a coated article without diluting with a solvent.
22. A coating method characterized by applying the coating composition as described in claim 1 on a steel surface on which rust remains and curing it to fix the rust.
23. A coating method characterized by applying the coating composition as described in claim 1 on a steel surface on which a coating film of an inorganic zinc-rich paint is formed.
24. An article coated by the method as described in any of claims 21 to 23.