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(54) **Title**: POLYURETHANE-ACRYLIC POLYMER DISPERSIONS AND USES THEREOF

(57) **Abstract**: Compositions for coating roofs, facades, floors or vertical facings comprising at least one acrylic polymer and at least one polyurethane polymer and at least one ethylene vinyl acetate emulsion are described, which compositions combine the advantages of the excellent features of polyurethane compositions with the reduced cost of acrylic compositions in such a manner that a balance between both characteristics is shown. Methods for covering a roof, facade, floor or vertical facing with these compositions and the use thereof as a coating for roofs, facades, floors or vertical facings are also considered.

POLYURETHANE-ACRYLIC POLYMER DISPERSIONS AND USES THEREOF

This application claims priority to European Patent Application No. 09382106.4 filed at the European Patent Office on July 2, 2009, the entire content of which is hereby incorporated by reference in its entirety.

Field of the Invention

The present invention relates to compositions combining an acrylic component with another polyurethane component, and uses thereof, particularly as liquid membranes for roofs.

State of the Art

Aqueous acrylic and polyurethane dispersions have been widely used in coating applications, both independently and in physical mixtures. By combining both components, the resulting coating shows a balance of properties from the individual inherent characteristics of acrylic and polyurethane products, the mixture benefiting from the better features of polyurethane and from the reduced cost of acrylic. This is particularly interesting in the case of outdoor coatings such as coatings for roofs.

However, the properties of these mixtures often do not achieve the aforementioned properties from the traditional "rule of mixtures". Though the reasons for these unwanted effects in physical mixtures have not yet been well defined, the non-homogeneity caused by the different acrylic and polyurethane domains certainly contributes to these effects. These areas can have excessive internal stress and/or incomplete coalescence, which will cause an increased permeability and reduced bond strength.

Thus, for example, patent document US 2001/0007711 A1 describes a method for coating concrete molds comprising the application of at least one plastic mineral composition which can bond to cement, comprising at least one aqueous polymer

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dispersion containing a percentage not exceeding 2% by weight of copolymerized monoethylenically unsaturated monomers.

Document WO 96/00259 also describes a method for producing a thermosetting elastomeric matrix, comprising vulcanizing an elastomeric material and a thermoplastic polymer material having a predetermined softening/melting temperature, producing a dispersion of the thermoplastic polymer material through the vulcanizable elastomeric material, and finally curing the thermoplastic-containing matrix.

Document US 2005/0124736 Al also describes aqueous polymer compositions containing at least one aqueous bitumen dispersion and at least one aqueous dispersion of at least one polyurethane. This composition is used in surface dressings and especially as watertight roof coatings.

Finally, patent US 4.331.726, issued to Patrick J. Cleary, describes pourable roofing compositions comprising discrete small chunks or pieces of closed cell plastics material, such as polyurethane, an inert particulate material, and an emulsion caulking or sealing type binder or adhesive based on acetates, acrylic resins, epoxy adhesives, and the like.

Accordingly, there is still a need for a composition which can be used as a liquid membrane for coating roofs, which is able to combine the advantages of the excellent features of polyurethane compositions with the reduced cost of acrylic compositions, showing a balance between both characteristics, for coating roofs and facades.

Any discussion of the prior art throughout the specification should in no way be considered as an admission that such prior art is widely known or forms part of common general knowledge in the field.

It is an object of the present invention to overcome or ameliorate at least one of the disadvantages of the prior art, or to provide a useful alternative.

Summary of the Invention

The problem to be solved by the present invention is therefore to provide aqueous compositions for coatings, and especially for outdoor coatings, such as coatings for roofs, showing a balance between the advantages of the better features of polyurethane and the reduced cost of acrylic.

According to a first aspect of the invention, there is provided a aqueous composition for coating roofs, facades, floors or vertical facings comprising

i) at least one acrylic polymer and

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ii) at least one polyurethane polymer and

iii) at least one ethylene vinyl acetate emulsion in an amount of between 5 and 40% by weight of the total weight of the composition

wherein the at least one acrylic polymer and the at least one polyurethane polymer are in the form of a combined product of at least one acrylic polymer with at least one polyurethane polymer.

According to a second aspect of the invention, there is provided a roof, facade, floor or vertical facing comprising the composition according to the first aspect.

According to a third aspect of the invention, there is provided a method for covering a roof, facade, floor or vertical facing with the composition according to the first aspect, comprising the following steps:

a) mechanically stirring the composition until homogeneity is achieved;

b) applying the composition produced in the previous step a) on the roof, facade, floor or vertical facing by means of a roller, brush, trowel or by spraying.

According to a fourth aspect of the invention, there is provided use of an aqueous composition according to the first aspect as a coating for roofs, facades, floors or vertical facings.

Unless the context clearly requires otherwise, throughout the description and the claims, the words “comprise”, “comprising”, and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of “including, but not limited to”.

In one embodiment, the solution is based on the fact that the inventors have identified that it is possible to achieve a polyurethane-acrylic composition by means of the combination of

i) at least one polyurethane polymer and

ii) at least one acrylic component and

iii) at least one ethylene vinyl acetate emulsion.

In one embodiment, the amount of the at least one ethylene vinyl acetate emulsion is of between 5 and 40% by weight of the total weight of the composition.

In one embodiment, the ethylene vinyl acetate emulsion balances the first two components ((i) and (ii)), and with it the advantageous characteristics of both. In such composition, the acrylic monomers and the urethane prepolymers are intimately mixed and mutually polymerized in aqueous dispersion, resulting in “hybrid” polyurethane-acrylic polymer dispersions. In the compositions of embodiments of the invention, as is believed, the result is an interpenetrating polymer network showing unique properties compared with standard acrylic dispersions, polyurethane dispersions, or

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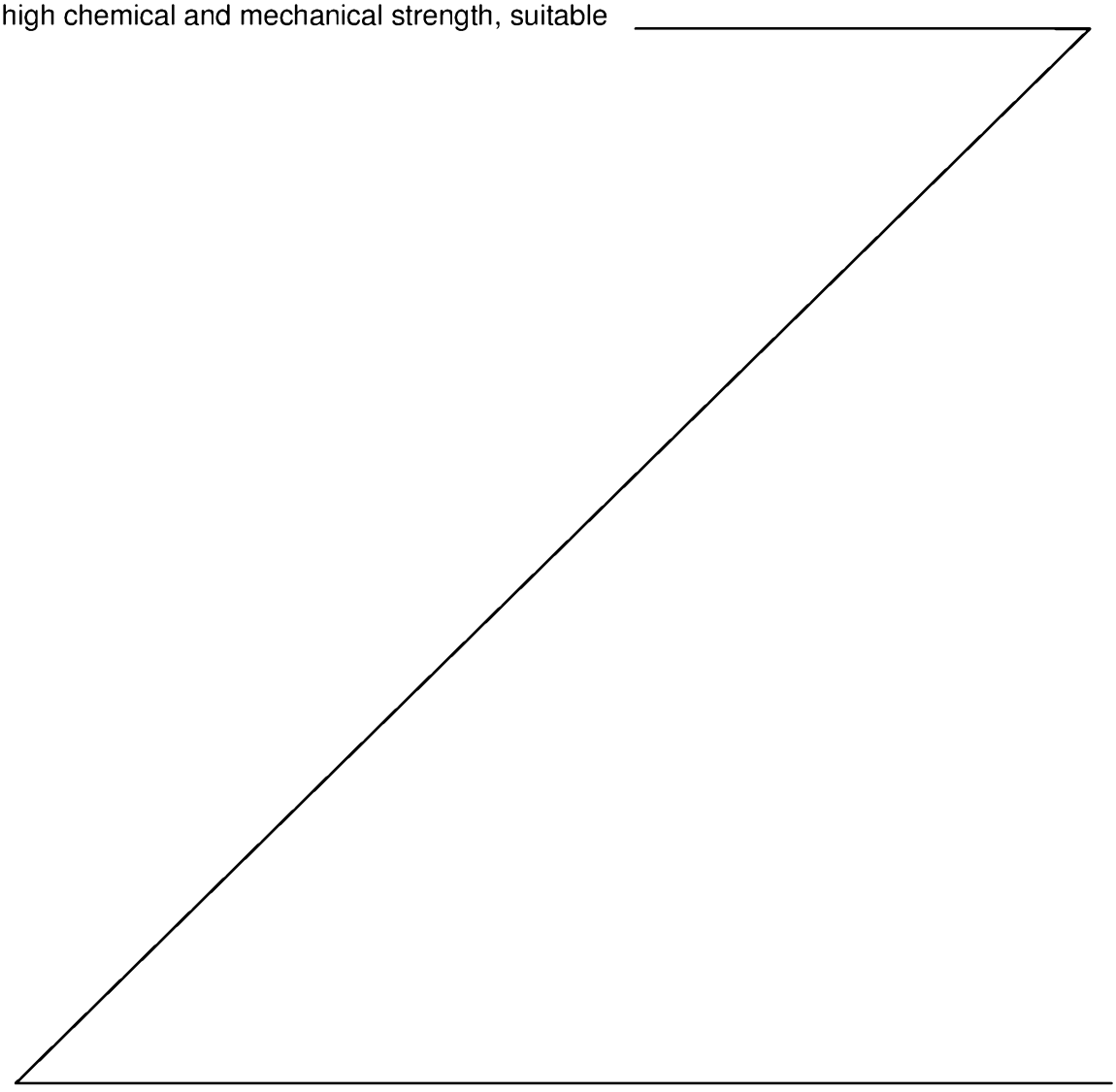
acrylic/urethane dispersions in macroscopic mixture. Without wishing to be bound by theory, the inventors believe that these properties seem to be directly attributable to the hybrid acrylic-polyurethane morphology. As is believed, these hybrid compositions are not the result of a copolymerization process, in which the acrylic and urethane segments are bound directly through primary bonds, nor are they mixtures with large acrylic and polyurethane domains. In contrast, the compositions of the invention seem to be acrylic and polyurethane chains which are intimately mixed at the molecular level and presumably remain bound through secondary intermolecular bonding forces which lead to a web of bound chains. Some of the additional advantages of the compositions of embodiments of the invention are their increased tensile strength, hardness, durability and resistance to chemical products and solvents, as well as the advantage that they are compositions which can be easily applied since they are one component (single pack) systems , odorless and organic solvent-free, they have a high chemical and mechanical strength, suitable



performance in terms of aging in extreme temperatures, and a satisfactory feature/cost ratio.

Definitions

In the present specification, "acrylic component" is understood as any acrylic acid derivative, preferably non-styrenic, although it could also be styrenic. "Acrylate" is understood as any acrylic acid derivative, polyacrylates, methacrylic acid or polymethacrylates. Examples of acrylic components are, for example, Acronal® 567, Revacryl® 473.

Also, in the present specification, "polyurethane component" is understood as any polymer composition consisting of chains of organic units bound by urethane bonds, and which are usually obtained by means of the condensation of polyols or polyesters with polyisocyanates. The polyurethane component does not have any free isocyanate groups left. Examples of polyurethane components are Esacote 21 or Prox R 910.

It must be observed that in the present invention, the acrylic and polyurethane components can be supplied to the compositions of the invention either as separate, individual components or as a single combined acrylic-polyurethane composition ("combined product").

Finally, in the present specification, "ethylene vinyl acetate emulsion" is understood as any aqueous composition resulting from the copolymerization of vinyl acetate and ethylene. This copolymerization is preferably carried out in the presence of a poly(vinyl alcohol) stabilizing system. The copolymer formed is hence referred to in the present text as "ethylene vinyl acetate".

Particular embodiments of the present invention are described below only as an example.

Detailed Description of the Invention

In a preferred embodiment of the invention, the acrylic and polyurethane components are provided in the form of a combined, single product, which is a product based on a pure

acrylic polymer, i.e., non-styrenic, thermoplastic, in an external surfactant aqueous emulsion, which has been modified with an aliphatic polyurethane polymer in aqueous dispersion/solution. This combined product can contain different proportions of the acrylic and polyurethane components, namely: in the preferred embodiments of the invention the concentration of the polyurethane component is from 5 to 85% by weight of the total weight of the combined product, more preferably from 7 to 75%, even more preferably from 10 to 50%, and most preferably from 10 to 30% by weight of the total weight of the combined product.

This combined acrylic-polyurethane product is supplied to the final compositions of the invention at a preferred concentration between 10 and 50% by weight of combined product of the total weight of the final composition; more preferably between 20 and 50% by weight, even more preferably between 30 and 40%, still more preferably between 35 and 40%, and most preferably around 37% of the total weight of the final composition.

The combined acrylic-polyurethane product is having typically a solid content of between 30 and 70 % by weight, particularly between 40 and 50% by weight, in view of the weight of the combined acrylic-polyurethane product. It is preferably an emulsion or dispersion.

To obtain the final compositions of the invention, an ethylene vinyl acetate emulsion is added to this combined product in a preferred proportion between 5 and 40% by weight of the total weight of the final composition, more preferably between 10 and 35%, even more preferably between 15 and 30%, still more preferably between 17 and 25%, and most preferably around 20% by weight of the total weight of the composition.

The ethylene vinyl acetate emulsion is having typically a solid content of between 30 and 70 % by weight, particularly between 40 and 50% by weight, in view of the weight of the ethylene vinyl acetate emulsion.

The rest of the composition up to 100% is optionally completed with one or more of the following additives: rheological additives, preservatives, bactericidal agents, de-airing agents, water repellant agents, filler wetting agents, fillers and pigments.

It has been found that the also in the absence of fillers which form silicate sheets (phyllosilicates) or chains (inosilicate) such as Mica, Muscovite, Wollastonite or Sericite an excellent hydrothermal and UV stability of the coating can be observed. Furthermore, also in the absence of phosphates excellent adhesion properties, particularly on concrete, can be obtained. Preferred filler is calcium carbonate, particularly ground calcium carbonate. This allows to formulate coatings which are cheap and nevertheless show the high performance of the present invention.

To produce the compositions of the invention, the indicated starting materials are added step-wise and are mixed in a suitable mixer, obtaining a one component (single pack) product which once applied forms a continuous and seamless membrane with a series of properties making it suitable for waterproofing newly constructed roofs or for restoration.

Its main advantages are:

- High resistance to UV radiation, without yellowing.
- It maintains its properties in severe conditions (hot and cold)
- High elasticity. Able to bridge cracks
- One component system (single pack)
- It does not contain organic solvents
- Once cured, it forms a completely continuous seamless membrane.
- Permeable to water vapor.

It has good adherence on a wide range of substrates after suitable treatment thereof: metal, concrete, wood and ceramic supports. In the case of concrete, the latter must have sufficient compressive strength and adherence greater than 0.8 N/mm^2 (according to EN 1504-2).

Substrate	Adherence (kg/cm^2)	Comment
Cement	27.53	Cohesive failure of concrete
Metal	24.3	Cohesive failure of concrete
Tile	15.6	Cohesive failure of concrete
Natural wood	20.9	Cohesive failure of concrete
Particle board	6.7	Cohesive failure of concrete
Fiber cement	9.14	Cohesive failure of concrete

Adherence has been tested according to standard EN 1542 (determination of adhesion by direct traction).

The compositions of the invention can be applied with ambient temperatures comprised between 8 and 35°C and maximum ambient humidity of 80% and on concretes with humidity less than 8%. They can be applied by means of a roller, brush, and trowel or by spraying. They are preferably applied in two phases, i.e. applying the second layer once the first one is dry; the first layer will in turn have a primer function. If considered necessary according to the characteristics of the work, the system can be reinforced in its entirety or simply in individual points by incorporating a polyester mesh (such as Silva Fleece 120). The thicknesses of the final system can range between 0.5 - 2.5 mm depending on the requirements of the roof.

The drying times depends on the temperature and is preferably as follows:

Temperature	Drying time for repainting
+10°C	7 hours
+20°C	6 hours
+30°C	4 hours
+40°C	3 hours

Temperature	Time after which it is resistant to rain
+10°C	5 hours
+20°C	3 hours
+30°C	3 hours
+40°C	2 hours

Temperature	Time after which it is resistant to pedestrian traffic
+10°C	24 hours
+20°C	16 hours
+30°C	16 hours
+40°C	8 hours

Hence a further aspect of the invention is a method for covering a roof, facade, floor or vertical facing with the composition disclosed above comprising the following steps:

a) stirring the composition by means of mechanical stirring until achieving complete homogeneity thereof;

b) applying the composition resulting from the previous step a) on the roof, facade, floor or vertical facing by means of a roller, brush, trowel or by spraying.

In one embodiment of the invention said method furthermore comprises step c):

c) applying the composition resulting from the previous step a) on dry layer obtained by step b) by means of a roller, brush, trowel or by spraying.

The above disclosed aqueous composition can be used as a coating for roofs, facades, floors or vertical facings.

A further aspect of the invention is a roof, facade, floor or vertical facing comprising the composition which is disclosed above.

Examples

Various compositions were subjected to testing: a composition according to the invention, designated as "AC-PU/VAE" and the compositions based on each polymer added independently, "AC-PU" and "VAE". These compositions were produced from the following components and by means of the process described below:

	AC-PU/VAE	**AC-PU**	**VAE**
AC-PU1[1] [% by weight]	37.00	57.00	
VAE1[2] [% by weight]	20.00		57.00
Thickener based on acrylic polymers [% by weight]	0.90	0.90	0.90
Anti-foaming additive [% by weight]	0.25	0.25	0.25
Preservative[3] [% by weight]	0.15	0.15	0.15
Dispersant and filler wetting agent and pigments [% by weight]	0.40	0.40	0.40
Pigment paste	11.00	11.00	11.00
Adherence enhancer [% by weight]	0.10	0.10	0.10
Calcium carbonate [% by weight]	28.70	28.70	28.70
Coalescent additive [% by weight]	1.50	1.50	1.50

Table 1. Description of the AC-PU/VAE, AC-PU and VAE compositions

[1] Acrylic/Aliphatic polyurethane polymer in aqueous emulsion, with a pH between 8 - 9, with a mean particle size less than 400 nanometers, solid content between 40 and 50%, density between 1.0 - 1.1 kg/l, Brookfield viscosity at 25°C between 5 - 500 cps, emulsified by means of anionic surfactants and stabilized by tensides. Its minimum film-forming temperature is between -10 and 10°C

[2] Aqueous dispersion based on ethylene/vinylacetate, with a pH between 4-5, with a mean particle size less than 0.6 micrometers, with solid content between 40-60%, with Brookfield viscosity at 25°C between 5-600 cps, stabilized

by tensides. Its minimum film-forming temperature is between -10 and 10°C

For their respective preparations, the ingredients listed in Table 1 were added and were intensely mixed with a dissolver until achieving a homogenous mixture with a particle size less than 60 microns.

Once the manufacturing process has ended in the case of the AC-PU/VAE product, a product with the following characteristics was obtained:

- Density at 23°C between 1.33 -1.37 kg/l
- Solid content between 64.5 and 66.5%, tested by subjecting the liquid product to a temperature of 105°C until reaching constant weight.
- Viscosity between 4000 and 5000 mPas measured with a Rheomat viscometer (Contraves) at a temperature of 20°C, at a rate of 415 rpm and with screw N. 3

Once the manufacturing process has ended in the case of the AC-PU product, a product with the following characteristics was obtained:

- Characteristics: Density (23°C): 1.31 kg/l
- Solid content by weight: 64.0%
- Viscosity (23°C): 3070 mPas (415 rpm/S3) (Contraves)
- Application: Homogenize the product by means of stirring, apply with short bristle roller in two layers with 1.0 kg/m^2 per layer.

Once the manufacturing process has ended in the case of the VAE product, a product with the following characteristics was obtained:

- Density (23°C): 1.31 kg/l
- Solid content by weight: 62.3%
- Viscosity (23°C): 2926 mPas (415 rpm/S3)(Contraves)
- Application: Homogenize the product by means of stirring, apply with short bristle roller in two layers with 1.0 kg/m^2 per layer.

These compositions were subjected to various tests,

comparing them with commercial products for continuous waterproofing of roofs:

- SKL 445: Trade name: SikaLastic® 445
  Manufacturer: Sika, S.A.U.
  Description: Roof waterproofing agent based on one component (single pack) polyurethane. Contains organic solvents.
  Characteristics: Density (23°C): 1.6 kg/l
  Solid content by weight: 88%
  Application: Homogenize by means of stirring the product, apply by means of short bristle roller in two layers with 1.6 kg/m2 per layer.
- SKL822: Trade name: SikaLastic 822
  Manufacturer: Sika, S.A.U.
  Description: Roof waterproofing agent based on two component polyurethane.
  Characteristics: Density component A (23°C): 1.69 kg/l
  Density component B (23°C): 1.03 kg/l
  Density of the mixture (23°C): 1.33 kg/l
  Solid content by weight: >96%
  Application: Mix the components A and B to complete homogeneity, apply by means of notched trowel, with a consumption of 2.6 kg/m^2
- DRYFLEX: Trade name: Dryflex P.U.M.P.
  Manufacturer: RLA Tile Adhesives
  Description: Roof waterproofing agent based on water-based modified polyurethane.
  Characteristics: Density (23°C): 1.25 kg/l
  Solid content by weight: 63%
  Application: Homogenize the product by means of stirring, apply with short bristle roller in two layers with 1.5 l/m^2 per layer.
- SIKAFILL: Trade name: Sikafill
  Manufacturer: Sika, S.A.U.
  Description. Roof waterproofing agent based on

styrene-acrylic copolymers in aqueous emulsion.
Characteristics: Density (23°C): 1.20 kg/l
Solid content by weight: 60%
Application: Homogenize the product by means of stirring, apply with short bristle roller in two layers with 1.0 kg/m^2 per layer.

- UV-CRS: Product formulated using acrylic resin as a base having a built-in UV crosslinking system
  Internal experimental formula not based on polyurethane or vinylacetate/ethylene emulsion.
  Characteristics: Density (23°C): 1.28 kg/l
  Solid content by weight: 62.6%
  Viscosity (23°C): 5300 mPas (200 rpm/S4)(Contraves)
  Application: Homogenize the product by means of stirring, apply with short bristle roller in two layers with 1.0 kg/m^2 per layer.

The testing program was performed with all the products described above for the purpose of checking and assessing the most important parameters for a product the function of which will be to waterproof roofs. These tests were:

1. Water absorption.
2. Liquid water permeability (UNE-EN 1063-3:2008)
3. Variation of the color after exposure to solar radiation.
4. Variation of mechanical properties after accelerated aging
5. Adherence to wet and dry concrete.

The obtained results were:

1. Water absorption test.

Specimens of all the products measuring 3 cm in diameter and 1 mm thick were prepared to conduct this test. After 20 days, period in which they all reached constant weight, they were immersed in deionized water at ambient temperature for 42 days, periodically extracting samples to weigh them after

drying with absorbent paper.

After 42 days, the immersion stops and the samples are left to dry at 23°C and 50% humidity for a period of 14 days. After this time, they are weighed again and a second cycle commences with the same previous process.

Results:

Days	1st Cycle / Weight gained (%)							
	SKL 445	SKL 822	DRY-FLEX	SIKA-FILL	UV-CRS	AC-PU	VAE	AC-PU/VAE
1	1.52	2.14	14.67	12.85	16.29	10.30	15.58	9.75
5	2.44	3.95	28.63	24.19	26.41	12.26	15.67	7.09
7	2.53	4.12	32.50	26.41	28.19	12.71	15.27	6.51
14	2.45	5.09	41.35	30.00	29.80	11.19	13.26	6.13
28	2.93	5.98	51.40	33.00	29.76	10.45	12.07	4.71
35	3.13	6.32	56.29	34.33	29.96	10.66	13.29	5.06
42	3.07	6.71	58.69	35.16	29.39	10.49	13.45	4.79

Days	2nd Cycle / Weight gained (%)							
	SKL 445	SKL 822	DRY-FLEX	SIKA-FILL	UV-CRS	AC-PU	VAE	AC-PU/VAE
1	1.45	2.51	2.93	3.63	7.18	2.45	4.36	4.23
5	1.90	3.86	7.18	7.17	8.75	5.38	6.34	5.40
7	2.38	5.11	10.73	10.05	10.12	8.05	8.40	5.03
14	2.69	6.26	15.19	13.80	10.58	11.84	8.92	5.40
28	3.01	7.22	20.90	17.67	9.17	14.56	8.68	5.33
35	3.18	8.01	23.13	19.14	9.76	16.06	9.01	5.36
42	3.12	7.93	24.78	20.02	8.75	16.75	8.79	5.32

2. Liquid water permeability test.

The test was conducted following the process described in standard UNE-EN 10633:2008. Concrete specimens with a liquid water transmission rate, w, exceeding 5 kg/($m^2h^{0.5}$) and density comprised between 1500-20005 kg/m^3, with a surface area of 200 cm^2 and minimum thickness of 2.5 cm are prepared. The specimens

are left to dry and coated with the products to be tested, applying the amount of product per square meter established in the corresponding technical product data sheets of the product.

The coating is left to dry for at least 7 days and the back and the edges of the specimen that will be in contact with the water are sealed, overlapping the test surface by at least 5 mm, but not more than 10 mm. The product used for sealing can be any water-repellant product, for example Sikaflex 11FC. The specimens were left to dry for another 24 days at 23±2°C and 50±5% relative humidity.

After drying, the specimens were subjected to aging before determining the liquid water transmission rate. To that end, three cycles are carried out consisting of the following:

- 24 hours in potable water at 23±2°C
- 24 hours of drying at 50±2°C
- 24 hours at 23±2°C and 50±5% relative humidity

The average thickness of each dry film was calculated from the consumption and the content of non-volatile material of the product according to standard UNE-EN 1062-1. Each specimen was weighed and they were placed in a container filled with water at 23°C and on a metal or plastic support with the surface coated downwardly, such that said face will be immersed 1 cm in the water. After 1 hour, 2 hours, 3 hours, 6 hours and 24 hours, the specimen was removed from the water and dried using to that end absorbent paper in order to be weighed.

With the obtained data, the increase of mass of the specimen divided by the surface in square meters, as a function of the square root of the time expressed in hours, was graphically represented. The slope of the linear part of the curve is the liquid water transmission rate, w, in $kg/m^2h^{0.5}$.

Liquid water permeability								
	SKL 445	SKL 822	DRY-FLEX	SIKA-FILL	UV-CRS	AC-PU	VAE	AC-PU/VAE
W ($kg/m^2h^{1/2}$)	0.0058	0.0082	0.0125	0.0245	0.0004	0.0174	0.0238	0.0128

3. Variation of the color after exposure to solar radiation.

The test was conducted by means of colorimetry, measuring the values of *L*, *a* and *b* of the products once they are cured (7 days after their application) and establishing this data as the pattern. Measurement is taken again after 60 days of exposure a sunlight with the boards inclined (45°) and oriented towards the south and located on the roof of the building. The variation with respect to the initial color is expressed by means of the term Delta E obtained from the following equation:

$$\Delta E^* = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$$

Variation of color after exposure to solar radiation outside								
	SKL 445	SKL 822	DRY-FLEX	SIKA-FILL	UV-CRS	AC-PU	VAE	AC-PU/VAE
Delta E	0.93	6.01	1.51	1.49	2.87	0.95	2.22	1.3

4. Variation of mechanical properties after accelerated aging

Elongation at break before and after accelerated aging.

- Aging due to heat (70°C / 160 days)

Another type of samples was prepared measuring 0.7 mm thick and are left to cure at 23°C and 50%. Once cured, the elongation at break is tested by means of an extensometer, at a rate of 200 mm/min. For each product, part of the samples is introduced in an oven at 70°C for 60 days, and after this time elongation at break is tested again. The variation occurring between the initial value and the value obtained after thermal aging is evaluated, expressing it in %.

Variation of elongation at break after thermal aging								
	SKL 445	SKL 822	DRY-FLEX	SIKA-FILL	UV-CRS	AC-PU	VAE	AC-PU/VAE
Initial elongation at break (%)	201	470	214	527	558	428	746	388
Final elongation at break (%)	37	432	45	417	362	278	757	386
Variation (%)	-81	-8	-79	-21	-35.1	-35	+1.5	-0.5

As can be observed, the compositions of the invention show very satisfactory elongation results.

- Aging in QUV (2000 h)

Part of the specimens prepared for the previous test are introduced in the QUV chamber for 2000 hours in which it is subjected to consecutive cycles consisting of 4 hours at 60°C and UV radiation of 340 nm and 4 hours of condensation at 50°C without UV radiation. Once the 2000 hours passed, the elongation at break is measured by means of an extensometer at a rate of 200 mm/min. This data is compared with the values obtained before aging and the variation between them is calculated, expressed in %.

Variation of elongation at break after thermal aging								
	SKL 445	SKL 822	DRY-FLEX	SIKA-FILL	UV-CRS	AC-PU	VAE	AC-PU/VAE
Initial elongation at break (%)	201	470	214	527	558	428	746	388
Final elongation at break (%)	231	180	Breaks before testing	303	61.7	223	806	334
Variation (%)	+15	-62		-43	-89	-48	+8	-14

The compositions of the invention show satisfactory elongation results, especially the initial results, though not so satisfactory after the 2000 hours of UV.

5. Adherence to wet and dry concrete.

The various products are applied as indicated in their technical data sheets on dry concrete (humidity < 4%) and on previously moistened concrete (humidity 15 - 20%), are left to

cure for 7 days and after this time the adherence is tested by means of direct traction equipment (Sattec). To that end, it is drilled with a diamond bit measuring 50 mm in diameter and to a depth equal to the applied product thickness plus 15- 20 mm. The 50 mm steel adhesion test pieces are glued by means of epoxy adhesive consisting of two components on the part separated with the drill and after 24 hours the measurement is taken.

Adherence to wet and dry concrete								
Adhesion (MPa)	SKL 445	SKL 822	DRY-FLEX	SIKA-FILL	UV-CRS	AC-PU	VAE	AC-PU/VAE
Dry concrete	2.75	8.80	2.32	2.16	1.92	2.07	1.53	1.92
Wet concrete	1.09	1.00	2.68	2.08	2.11	2.08	1.52	2.11

The results of the compositions of the invention in this test are consistent with the mean results of the various studied compositions.

As indicated above, the polyurethane and acrylic components have been supplied in the described embodiment as a single, previously combined, product due to the comfort and ease of obtaining it commercially. However, the inventors consider that the results would have been substantially the same if both components had been supplied to the compositions of the invention separately.

In summary, the acrylic-polyurethane-VAE (AC-PU/VAE) compositions of the invention showed good results in all the tests, and are close to those of polyurethane compositions, though with a considerably more reduced cost.

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CLAIMS

1. Aqueous composition for coating roofs, facades, floors or vertical facings comprising
   i) at least one acrylic polymer and
   ii) at least one polyurethane polymer and
   iii) at least one ethylene vinyl acetate emulsion in an amount of between 5 and 40% by weight of the total weight of the composition
   wherein the at least one acrylic polymer and the at least one polyurethane polymer are in the form of a combined product of at least one acrylic polymer with at least one polyurethane polymer.

2. The composition according to claim 1, wherein the ethylene vinyl acetate emulsion is in an amount of between 15 and 30% by weight of the total weight of the composition.

3. The composition according to claim 1 or 2, wherein the ethylene vinyl acetate emulsion is in an amount of between 18 and 22% by weight of the total weight of the composition.

4. The composition according to claim 1, wherein in the combined product of at least one acrylic polymer with at least one polyurethane polymer, the at least one polyurethane polymer is in a proportion between 5 and 85% by weight of the combined product.

5. The composition according to claim 4, wherein in the combined product of at least one acrylic polymer with at least one polyurethane polymer, the at least one polyurethane polymer is in a proportion between 10 and 50% by weight of the combined product.

6. The composition according to claim 4 or 5, wherein in the combined product of at least one acrylic polymer with at least one polyurethane polymer, the at least one polyurethane polymer is in a proportion between 10 and 30% by weight of the combined product.

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7. The composition according to any one of the preceding claims, wherein the combined product of at least one acrylic polymer with at least one polyurethane polymer is in a concentration between 10 and 50% by weight of the total weight of the composition.

8. The composition according to claim 7, wherein the combined product of at least one acrylic polymer with at least one polyurethane polymer is at a concentration between 30 and 40% by weight of the total weight of the composition.

9. The composition according to claim 7 or 8, wherein the combined product of at least one acrylic polymer with at least one polyurethane polymer is at a concentration of approximately 37% by weight of the total weight of the composition.

10. The composition according to any one of the preceding claims, wherein the acrylic polymer is a thermoplastic, non-styrenic polymer in an external surfactant aqueous emulsion.

11. The composition according to any one of the preceding claims, wherein the polyurethane polymer is an aliphatic polymer in aqueous solution or dispersion.

12. The composition according to any one of the preceding claims, wherein the water content is between 10 and 40% by weight of the total weight of the composition.

13. A roof, facade, floor or vertical facing comprising the composition according to any one of the preceding claims 1 to 12.

14. A method for covering a roof, facade, floor or vertical facing with the composition according to any one to any one of the preceding claims 1 to 12, comprising the following steps:

a) mechanically stirring the composition until homogeneity is achieved;

b) applying the composition produced in the previous step a) on the roof, facade, floor or vertical facing by means of a roller, brush, trowel or by spraying.

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15. The method according to claim 14, further comprising step c):

c) applying the composition produced in previous step a) on the dry layer generated by step b) by means of a roller, brush, trowel or by spraying.

16. The method according to claim 14 or 15, furthermore comprising adding a polyester mesh to the coating surface or to individual points thereof.

17. Use of an aqueous composition according to any one of the preceding claims 1-12 as a coating for roofs, facades, floors or vertical facings.

18. An aqueous composition for coating roofs, facades, floors or vertical facings; a roof, facade, floor or vertical facing comprising the composition; a method for covering a roof, facade, floor or vertical facing; or a use of an aqueous composition substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying examples but excluding comparative examples.