Lixomat

LIME-BASED BINDERS
FOR MATT CEILING
PAINTS

groupe berkem

Lime-based paints

Ever since Antiquity, lime-based ($Ca(OH)^2$) paints have been used for their decorative properties but also for their sanitising properties. Abandoned and considered anecdotal, professionals have rediscovered the qualities of theses paints especially for the texture and tones that only lime- based paints can provide. Indeed, theses paints provide an unequalled white. The “imperfection” of its finish gives relief and depth. Time and ageing give them a patina that no other material can create.

Furthermore, while decorating a surface, these lime-based paints:

> fill micro-cracks,

> protect the substrates.

They allow the walls to breathe because lime is permeable to water vapour. They thereby:

> regulate moisture,

> reduce the formation of damp patches.

This porosity takes nothing away from its hardness or strength.

Indeed, the film of paint undergoes the same carbonation process as a lime-based sealant and offers a protective role via the calcium carbonate layer that re-forms over time.

Since Antiquity, slaked lime has been known for its:

> bactericide,

> and disinfectant properties.

Indeed, living organisms are vulnerable to high pH levels, leading to its anti-microbial and anti-parasitic actions. Thus, lime destroys bacteria providing to the applied support aseptic properties.

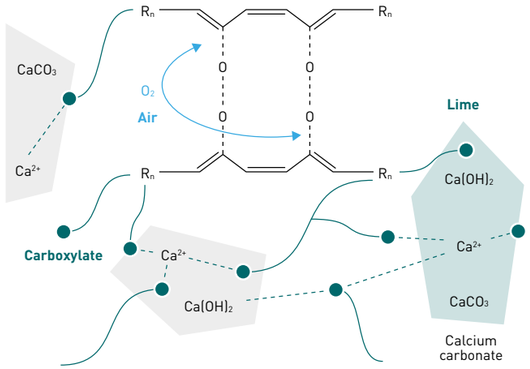
Lime paints are known for their matting power, their insulating properties and their ease of application (no- surface-tension).

Lime-based binders

Today, Groupe Berkem, manufacturer of Alkyd resins, is presenting two lime-based binder solutions:

- One solvent-based lime-based binders: **LIXOMAT D60** (also available **LIXOMAT 35 D60** and **LIXOMAT 35 IL** versions)
- One water-based lime-based binder: **LIXOMAT HYDRO**

These binders are the result of a combination between a high viscosity standoil and slaked lime. The action of slaked lime on standoil leads to the formation of calcium salts, carboxylates and calcium carbonate. Thus the binder particles are linked by coordination and by the crosslinking generated during the drying of the standoil. These interactions strengthen the binder's compact structure.



Scheme of the typical structure of a lime-based binder (S. Fang et al.; *International Journal of Adhesion & Adhesives* ; 48 (2014) 224-230)

	LIXOMAT D60	LIXOMAT 35 D60 / IL	LIXOMAT HYDRO
Solvent	White Spirit D60	White Spirit D60 / IL	Water
Non volatile content, %	40 ± 1	35 ± 1	62 ± 2
Acid value, mg KOH/g resin 100%	≤ 7	≤ 7	-
Density at 20°C	0,84	0,84	0,96
pH	-	-	7 ± 0,5
Oil length, %	96 ± 2	96 ± 2	80 ± 2
Odour	White Spirit	White Spirit / -	Low Odour
VOC	60 %	65 %	<10 g/L
Flash point (°C)	> 60	> 60	> 100°C
Chemical type	Gel	Gel	Emulsion

Orientation formula

1 MATT LIME-BASED PAINT CONTAINING LIXOMAT 35 D60

Lime-based binder	LIXOMAT 35 D60	40.72 %
Wetting agent	SOYA LECITHIN	1.26%
Titane dioxide	TIONA 595	1.29%
Kaolin	METASIAL ZS	8.14%
Calcium carbonate 10 µm	CRISCAL 10	14.25%
Calcium carbonate 5 µm	CRISCAL 5	14.25%
Solvent	WHITE SPIRIT D60	4.07%
Driers	ECOS MIX 26 NEO D60	0.61%
Anti-skin agent	TROYMAX ANTISKIN MP	0.41%

Viscosity at 23°C (Brookfield, RV5, 60 RPM)	5700 cP
Density at 25°C	1.1
Non volatile content	70%
Dust-free drying time	5 h.
VOC according to directive 2004/42/CE	343 $g.L^{-1}$

Persoz hardness at 15 days according to ISO 1522 (film applied at 100 µm)	31 s
Brightness according to ISO 2813	85° = 2.6 B.U.
Cross-cut test according to ISO 2409	0

2 MATT WATER-BASED LIME-BASED PAINT CONTAINING 100% LIXOMAT HYDRO

Thickener	XANTHANE GUM TGRD	0.25%
Water	WATER	23.10%
Wetting agent	DISPERBYK-190	1.50%
Sequestering additive	SODIUM HEXAMETHAPHOSPHATE SOLUTION AT 20 %	0.90%
Co-solvent	MONOPROPYLENE GLYCOL	2.30%
Anticorrosion pigment	AB RUST	0.30%
pH additive	AMP 90	0.20%
Drier	OCTA-SOLIGEN CALCIUM 10	0.10%
Defoamer	BYK-1640	0.20%
Titane dioxide	TIONA 595	20.00%
Extender	SIPERNAT 820 A	6.00%
Kaolin	METASIAL ZS	4.00%
Calcium carbonate 2 µm	CRISCAL 2	10.00%
Calcium carbonate 5 µm	CRISCAL 5	8.00%
Water-based lime-based binder	LIXOMAT HYDRO	22.00%
Driers	BORCHI OXY-COAT 1101	0.20%
	BORCHERS DECA ZINC 10 AQUA	0.30%
	OCTA-SOLIGEN ZIRCONIUM 10 AQUA	0.30%
Biocide	MERGAL 712	0.20%
Anti-skin agent	PENTANONE OXIME	0.15%

Viscosity at 23°C (Brookfield, RV5, 50 RPM)	3200 cP
Density at 25°C	1.5
Non volatile content	61.5%
Dust-free drying time	15 min.
VOC according to directive 2004/42/CE	3 $g.L^{-1}$
Persoz hardness at 15 days according to ISO 1522 (film applied at 100 µm)	19 s
Brightness according to ISO 2813	85° = 2.4 B.U.

3 PAINT CONTAINING A BLEND OF ACRYLIC/LIXOMAT HYDRO

Thickener	XANTHANE GUM TGRD	0.25%
Solvent	WATER	22.90%
Wetting agent	DISPERBYK-190	1.50%
Sequestering additive	SODIUM HEXAMETHAPHOSPHATE SOLUTION AT 20 %	0.90%
Co-solvent	MONOPROPYLENE GLYCOL	2.30%
Anticorrosion pigment	AB RUST	0.30%
pH additive	AMP 90	0.20%
Drier	OCTA-SOLIGEN CALCIUM 10	0.10%
Defoamer	BYK-1640	0.20%
Titane dioxide	TIONA 595	20.00%
Extender	SIPERNAT 820 A	6.00%
Kaolin	METASIAL ZS	4.00%
Calcium carbonate 2 µm	CRISCAL 2	10.00%
Calcium carbonate 5 µm	CRISCAL 5	8.00%
Water-based lime-based binder	LIXOMAT HYDRO	13.00%
Driers	BORCHI OXY-COAT 1101	0.20%
	BORCHERS DECA ZINC 10 AQUA	0.30%
	OCTA-SOLIGEN ZIRCONIUM 10 AQUA	0.30%
Acrylic styrene binder	AXILAT DS 910	9.00%
Biocide	MERGAL 712	0.20%
Coalescent agent	TEXANOL	0.50%
Anti-skin agent	PENTANONE OXIME	0.15%

Viscosity at 23°C (Brookfield, RV5, 50 RPM)	3000 cP
Density at 25°C	1.5
Non volatile content	61.5%
Dust-free drying time	15 min.
VOC according to directive 2004/42/CE	10 $g.L^{-1}$
Persoz hardness at 15 days according to ISO 1522 (film applied at 100 µm)	34 s
Brightness according to ISO 2813	85° = 2,4 B.U.

4 CLASSIC ACRYLIC PAINT

Thickener	NATROSOL PLUS 330 PA	0.36%
Solvent	WATER	20.76%
Wetting agent	COADIS BR 3	0.40%
Sequestering additive	SODIUM HEXAMETHAPHOSPHATE SOLUTION AT 20 %%	0.89%
Co-solvent	MONOPROPYLENE GLYCOL	1.47%
Anticorrosion pigment	AB RUST	0.35%
pH additive	AMP 90	0.17%
Defoamer	ANALYFOAM 98 TB7	0.25%
Biocide	ACTICIDE ICB 6	0.10%
Titane dioxide	TIONA 595	14.28%
Kaolin	METASIAL ZS	6.13%
Calcium carbonate 2 µm	CRISCAL 5	14.07%
Calcium carbonate 5 µm	CRISCAL 10	9.20%
Coalescence agent	TEXANOL	0.98%
Acrylic styrene binder	AXILAT DS 910	30.62%

Viscosity at 23°C (Brookfield, RV5, 50 RPM)	2952 cP
Density at 25°C	1.44
Non volatile content	61%
Dust-free drying time	1 h.
VOC according to directive 2004/42/CE	29 $g.L^{-1}$

Persoz hardness at 15 days according to ISO 1522 (film applied at 100 µm)	112 s
Brightness according to ISO 2813	85° = 1.6 B.U.
Cross-cut test according to ISO 2409	0

Test results

- All the paints are matt, or even highly matt (<5 B.U. at 85°).
- Lime-based binders blended with acrylic styrene binders improve the flexibility property of the dried- film of the paint.
- **Contrary to acrylic paint, lime-based binder paint can be used on damaged substrates.**

	Persoz hardness at 15 days	Gloss	Cross-cut test
LIXOMAT 35 D60	31 s	85° = 2.6 B.U.	0
100 % LIXOMAT HYDRO	19 s	85° = 2.4 B.U.	0
LIXOMAT HYDRO & acrylic paint blend	34 s	85° = 2.4 B.U.	0
Classic acrylic paint	112 s	85° = 1.6 B.U.	0

Lime-based paints can be easily coloured and allow to obtain all the desired colours.

Properties of lime-based binders

Opacity test

This test consists in tracing three lines (pencil, red marker, black marker) on a painted substrate and then successively applying 120 µm paint's layers until the lines are totally covered.

This test has been used to compare classic acrylic paint with matt lime-based paint containing **LIXOMAT 35 D60.** The covering of the pencil lines (on the 3rd layer, 360 µm) and the black marker (on the 4th layer, 480 µm) is comparable for both paints.

The red marker line is covered on the fourth layer with the matt lime-based paint containing **LIXOMAT 35 D60** whereas with the classic acrylic paint, the red line is not covered due to the water-solubility of the red pigment.

Overlapping marks test

This test has been carried out to assess the ease of application and the open drying time of the paint before keeping marks due to the drying.

Classic acrylic paint is compared to the acrylic/**LIXOMAT HYDRO** mix paint as well as to the matt lime-based paint containing **LIXOMAT 35 D60**.

These overlapping marks tests consist in applying a first coat of paint in the centre of a plasterboard substrate, then applying a second coat that partially covers the initial one (on the left) 2 minutes after and then a third one that partially covers the initial one (on the right) 4 minutes after the first application.

Opacity test between a classic acrylic paint (A) and matt lime- based paint containing LIXOMAT 35 D60 (B)

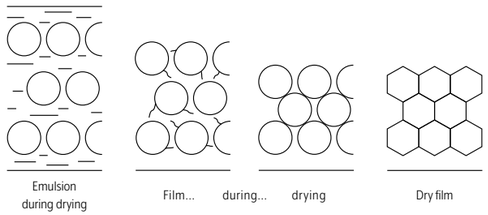
Overlapping marks test with acrylic classic paint

Overlapping marks test with matt lime-based paint containing LIXOMAT 35 D60

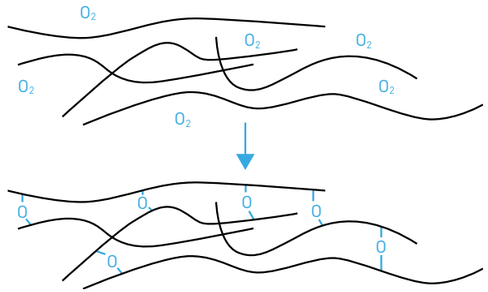
The test carried out using classic acrylic paint shows significant overlapping marks at 2 and 4 minutes. The blending of this acrylic paint with **LIXOMAT HYDRO** reduces these resumption marks. Finally, the use of the matt lime-based paint containing **LIXOMAT 35 D60** eliminates theses overlapping marks due to the paint's longer open time provided by **LIXOMAT 35 D60**. No overlapping marks can be seen.

No-surface-tension properties

Acrylic binders used are an emulsion of acrylic polymers in water. They create a film via a drying phenomenon known as coalescence. During the evaporation of the water (physical drying of the emulsion), due to the capillary forces, the polymer particles interpenetrate each other to form a continuous film as shown in the figure below.



Coalescence phenomenon (from « Initiation à la conception et à la réalisation des peintures, B. Anziani-Vente, AFTPVA section méditerranée, ISBN : 2-9520 528 »)



Alkyd/LIXOMAT resin film drying principle

During coalescence, the resin particles merge due to the action of the co-solvent to form a film. During this coalescence phenomenon, the particles retract as does the film. This retraction is a source of film tension.

Lime-based binders follow another drying mechanism called "oxidative drying". Indeed, natural drying oils have double bonds (unsaturations). Theses double bonds react with the oxygen from the air in presence of a drier to generate crosslinking and to finally form a film.

This oxidative drying mechanism therefore generates an in situ film without creating tension. This different drying mechanism compared to coalescence, combined with the flexible structure of the lime-based binder, brings a no- surface-tension property to the paint. This prevents cracking, peeling or flacking of the substrate once the paint has been applied.

Stain-blocking test

The purpose of this simple test is to highlight the good stain- blocking property of lime-based binders. This test consists in creating three series of stains on a plasterboard plate using the following products: oil, coffee, tobacco, wine, wood tannin and wall washing product. These spots are left for one hour in order to mark the substrate, and are then wiped and dried.

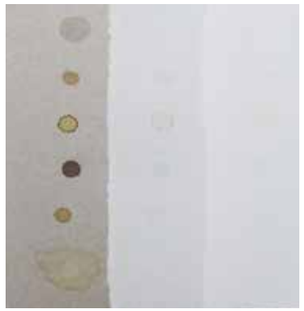
Paint is then applied on these stains in order to evaluate the capacity of the paint to block the migration of theses stains to its surface. A layer of paint is applied on the centre serie and two on the right serie.

Classic acrylic paint has difficulties to block the migration of most stains through the layer. Indeed, the stains are still visible after two layers of paint (see figure below).

Blend the **LIXOMAT HYDRO** with the acrylic paint improves the capacity of the paint to block the stains as shown in the figure.

Water-based limed matt paint containing 100% **LIXOMAT HYDRO** improves the stain-blocking property even more. Only the tobacco and coffee stains remain partially visible.

The use of the solvent-base **LIXOMAT** (**D60**, **IL** and **35 D60**) in paint provides an excellent stain-blocking property to the paint. Indeed, the stains are blocked as soon as the first layer is applied as shown in the figure.



Stain-blocking test of the acrylic classic paint

Stain-blocking test of the paint containing a blend of acrylic/LIXOMAT HYDRO

Stain-blocking test of the matt lime- based paint containing LIXOMAT 35 D60

Perspectives

Lime-based binders, which has been used for over half a century, remain despite the development of others technology and regulations in terms of VOC (deco- directive) due to its many advantages that no other binder can provide alone.

Today, it is an incomparable product for the renovation of a substrate damaged by water or fire, because it allows painters to limit their substrate preparation work while getting an excellent result and ease of application.

The no-surface-tension properties of paints using lime-base binders, their optimum drying properties allowing to apply “wet on wet”, or their specific texture, are sufficient to explain their main uses to formulate matt ceiling paints but is also a solution that is suitable and efficient for wall applications.

Lime-based paints are used to uniform different types of irregular surfaces such as old or new stone walls.

Lixomat

LIME-BASED BINDERS
FOR MATT CEILING
PAINTS

Use biocidal products with care. Read the label and product information before use.

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Construction & Materials

A business area of Groupe Berkem

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